I love my car: Conditions of a positive human-car attachment

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Zusammenfassung

Über seine instrumentelle Funktion hinaus kann das Automobil im Leben von Nutzenden eine bedeutende Rolle als Träger von Emotionen, Erinnerungen und Identität einnehmen. Angesichts dieser emotionalen Komponente erscheint es überraschend, dass die systematische Untersuchung der emotionalen Bindung zum Auto bislang eher vernachlässigt wurde. Die vorliegende Dissertation widmet sich dieser Forschungslücke.

In der ersten Studie wurden explorativ Emotionen im Kontext der Autonutzung, relevante Fahrzeugeigenschaften, die Entwicklung der emotionalen Bindung im Laufe der Zeit und relevante Determinanten von Produktbeziehungen beim Auto untersucht. Hierfür wurden teilstrukturierte Interviews (N = 36) mit Besitzenden, Leasingnehmenden, Carsharing-Nutzenden und Mietwagen-Nutzenden geführt. Dabei wurden sowohl qualitative als auch quantitative Methoden genutzt. Die Ergebnisse zeigen Unterschiede in Intensität und Qualität der emotionalen Bindung zum Auto zwischen den Nutzergruppen: Besitzende weisen die stärkste Bindung auf, gefolgt von Leasingnehmenden und Carsharing-Nutzenden, während Mietwagen-Nutzende keine bedeutende emotionale Bindung zeigen. Zudem konnten vier Nutzungsphasen identifiziert werden, die sich durch ihre emotionalen Besonderheiten unterscheiden: die Kennenlernphase, die Phase der alltäglichen Nutzung, Phasen von Defekten und Störungen beim Auto sowie die Abschiedsphase.

Die gewonnenen Erkenntnisse wurden durch drei quantitativen Online-Studien (jeweils N = 410, N = 487, N = 600) unter Berücksichtigung der Fahrzeugklasse überprüft. Hierbei bestätigen sich die Befunde aus den Interviews weitgehend, und es zeigte sich, dass die emotionale Bindung zu Premiumfahrzeugen oft stärker ist als zu Volumenfahrzeugen.

Anschließend wurden in sechs qualitativen Fokusgruppen (insgesamt N = 35) die verschiedenen Nutzungsphasen detaillierter diskutiert und Ansätze zur emotionalen Unterstützung der Nutzenden in diesen Phasen entwickelt. Der Fahrzeugwechsel, bestehend aus Abschied des alten Autos und Erhalt des neuen, stellte sich als besonders emotional für die Nutzenden heraus. Als potenziell hilfreich wurden das Bewahren von Erinnerungen an das alte Fahrzeug sowie die Steigerung der Vorfreude auf das neue Auto identifiziert.

Um die entwickelten Ideen in der Praxis zu erproben, wurden zwei prototypische App-Varianten konzipiert, die darauf abzielten, den Nutzenden emotional beim Fahrzeugwechsel zu unterstützen. Die erste Variante ermöglichte das Speichern von Erinnerungen an das alte Auto. Die zweite Variante sollte die Vorfreude auf das neue Auto intensivieren.

Die Prototypen wurden in teilstrukturierten Interviews (N = 43) mittels qualitativer und quantitativer Methoden evaluiert. Dabei wurden sowohl Nutzende mit emotionaler Bindung als auch solche ohne emotionale Bindung einbezogen. Die Ergebnisse zeigen, dass insbesondere die Stimulation der Vorfreude den Fahrzeugwechsel emotional erleichtert und die Bindung zum neuen Auto positiv beeinflusst. Das Speichern von Erinnerungen kann ebenfalls hilfreich sein, birgt jedoch das Risiko, den Abschied vom alten Auto zu erschweren, da die Bindung zu diesem verstärkt werden kann.

Zusammenfassend demonstrieren die Ergebnisse dieser Dissertation die bedeutende Rolle emotionaler Bindungen im Kontext der Autonutzung und die differenzierten Bedürfnisse verschiedener Nutzergruppen in unterschiedlichen Nutzungsphasen. Diese Erkenntnisse bieten relevante Implikationen für Automobilhersteller und Flottenanbieter, da die Stärkung emotionaler Bindungen das Potenzial birgt, Kundenzufriedenheit und -loyalität nachhaltig zu erhöhen.

Abstract

In summary, the results of this dissertation demonstrate the significant role of emotional attachments in the context of cars and the differentiated needs of various user groups in different usage phases. These findings offer relevant implications for automobile manufacturers and fleet providers, as strengthening emotional attachments can sustainably increase customer satisfaction and loyalty.

Beyond its instrumental function, the car can assume a significant role in users' lives as it evokes emotions, stores memories, and fosters a deep attachment. Given this emotional component, it seems surprising that the systematic investigation of emotional attachment to cars has so far been rather neglected. This dissertation addresses this research gap.

The first study exploratively examined emotions in the context of car usage, relevant car characteristics, the development of emotional attachment over time, and relevant determinants of product attachments to cars. For this purpose, semi-structured interviews ($N = 36$) were conducted with owners, lessees, car sharing users, and rental car users. Both qualitative and quantitative methods were employed. The results reveal differences in the intensity and quality of emotional attachment to cars across user groups: owners exhibit the strongest attachment, followed by lessees and car sharing users, while rental car users show no significant emotional attachment. Furthermore, four use phases could be identified, which differ in their emotional characteristics: the familiarization phase, the phase of everyday use, the phase of malfunctions and defects, and the farewell to the car.

These insights gained were verified by three quantitative online studies (each $N = 410$, $N = 487$, $N = 600$), taking into account the car class. These studies confirmed the interview findings and indicated that emotional attachment to premium cars is often stronger than to volume cars.

Subsequently, the various use phases were discussed in more detail in six qualitative focus groups ($N = 35$), and approaches for emotionally supporting users in these phases were developed. The car change, consisting of the farewell to the previous car and receiving the new one, proved to be particularly emotional for users. Preserving memories of the previous car and increasing the anticipation of the upcoming car were identified as potentially helpful.

To test the generated ideas in practice, two prototypical app variants were developed to emotionally support users during the car change. The first variant enabled storing memories of the previous car. The second variant was intended to intensify the anticipation of the upcoming car.

The prototypes were evaluated using qualitative and quantitative methods in semi-structured interviews (N = 43). This included users with and without emotional attachment. The results show that stimulating anticipation emotionally facilitates the car change and already fosters the attachment to the upcoming car. Storing memories can also be helpful, but it carries the risk of making the farewell to the previous car more difficult, as the attachment to it can be strengthened.

In summary, the results of this dissertation demonstrate the relevance of emotional attachments in the context of cars and the differentiated needs of various user groups in different usage phases. These findings offer relevant implications for automobile manufacturers and fleet providers, as strengthening emotional attachments can increase customer satisfaction and loyalty.

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Overview of Articles

Chapter 2 is based on paper 1 (submitted):

Grund, M., Totzke, I., & Engeln, A. (submitted). The emotional attachment between humans and their cars: dimensions, dynamics, and implications.

Chapter 3 is based on paper 2 (submitted):

Grund, M., Totzke, I., & Engeln, A. (submitted). Understanding Emotional Attachments to Cars: Insights from Multiple Online Surveys.

Chapter 4 is based on paper 3 (published):

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Chapter 6 is based on paper 4 (accepted):

Grund, M., Totzke, I., & Engeln, A. (2025). Enhancing the car change emotionally: Insights from a mixed method approach. *Journal of User Experience* (accepted)

1. Introduction

Is it weird to love your car?

I just got my first car, and I feel like I have developed a huge connection to it. Every time I just look at it, I am beaming with happiness. I put all my money into the car and even talk to it in some situations. I would not give it back for all the money in the world!! (gutefrage, 2022)

Selling My Beloved Car Tomorrow :(

Tomorrow, I will likely sell my car. It was my first car, purchased with my own money (I had it for 2 years), and I was very, very proud of it, even though it was 'just' a 20-year-old Clio. Unfortunately, the car is somewhat broken, and I could not afford the repair, nor would it have been worth it. Today, my mom took charge and put the car up for sale. I had always intended to do it myself but never managed to. It sounds silly, but I really struggle with this. Every time I think about it, I start crying. I also do not have the money to buy a new one at the moment. Do you have any ideas on how I can cheer myself up or cope better? I know it sounds ridiculous, but I have not treated myself to anything else besides my car. (gutefrage, 2012)

These two posts from users in an online forum express their emotional attachment to their car. The car is not just a commodity for them. Instead, it evokes emotional responses like pride and sadness when they have to part with their car. These are not isolated cases. A survey in the United States corroborates this emotional attachment: 64% of participants consider their car as a friend, and a third would even rather take a scratch themselves than see their car get one (SWNSDigital, 2019). Furthermore, more than 10% would rather break up with their partner than part with their car. Nearly half of the participants admit to shedding tears when saying goodbye to their car. Moreover, over half of the participants still regret giving up a car they loved, as they associate so many deep memories with it.

These quotes and survey results reflect the emotional attachment people can develop to their cars and how difficult it can be for some to part with them.

1.1 Emotional attachments to cars

The car serves not only as a means of transportation but also fulfills symbolic and affective functions that address deeper needs and emotions (Eckholdt et al., 2013; Hassenzahl, 2018; Steg, 2005). The car enables social participation, like visiting friends, pursuing hobbies, traveling for vacations, and commuting to work (Kent, 2014; Stanley et al., 2011). Consequently, memories with the car accumulate, and a shared history is created (Steg, 2005). Moreover, cars serve as a means of self-expression and positioning within the social environment and can be seen as an extension of the self (Mugge et al., 2010). This is evident in the choice of car, configurations, and personalization, such as stickers or decorations in the car. Furthermore, the car is considered a symbol of freedom, independence, and social status (Sheller & Urry, 2000). Especially premium cars from prestigious brands can express success (Belk, 1988). Additionally, the car stimulates the user through driving pleasure, speed, and new features.

Traditionally, car ownership dominated as the primary form of individual mobility. It remains a central element of individual mobility, providing the user full ownership rights. With increasing urbanization and awareness of ecological sustainability, the spectrum of car usage has notably expanded over the past decades. Alternative models to buying a car, such as leasing, car sharing, and rental cars, have become increasingly popular. Leasing offers a flexible and often economical alternative to direct car purchase. It allows having a car without owning it, which can be particularly advantageous during times of economic uncertainty (Hartmann-Wendels, 2003). Car sharing has established itself as an environmentally friendly and community-oriented mobility solution, contributing to the reduction of the number of cars on the roads and thereby alleviating urban infrastructure (Witzke, 2015). Different forms of car sharing exist: station-based car sharing and free-floating car sharing (Friedel, n.d.). In station-based car sharing, the cars have fixed locations. This means users pick up the car at a specific station and must return it to the same station after their trip. In contrast, free-floating cars are flexibly distributed within a defined area. Users can spontaneously book an available car at any location within this area and park it at another permissible location after their trip. Rental cars provide another flexible mobility option, primarily used for short-term needs and when traveling. These mobility forms differ particularly in terms of ownership status and the duration of car use.

Initial studies suggest both the ownership status and the duration of car usage can influence the emotional attachment to a car (Bardhi & Eckhardt, 2012; Fraine et al., 2007; Schaefers, 2013). For instance, limited-term usage, such as car sharing and renting, may hinder the development of emotional attachment (Bardhi & Eckhardt, 2012). Schaefers (2013) notes that the relationship of car sharing users to their cars is more pragmatic than emotional, even though they present a sustainable lifestyle using shared cars. This pragmatic perspective could indicate that emotional attachment to a car is strongly linked to the sense of ownership.

Emotional attachments can significantly influence purchasing decisions and brand loyalty (Schau et al., 2009). Such attachments also alter the perception and evaluation of car attributes and performance, potentially making emotionally attached users less sensitive to objective defects (Belk, 1988). Moreover, these attachments can affect driving behavior and the willingness to use alternative modes of transportation, which in turn impacts environmental pollution and traffic congestion (Steg, 2005).

Thus, investigating emotional attachments to cars has far-reaching implications for the automotive industry, urban planning, and environmental policy. A profound understanding of these attachments can help manufacturers develop products and services that align with the needs and desires of users in a better way. Simultaneously, it can contribute to promoting more sustainable mobility solutions and facilitating the transition to eco-friendly modes of transportation.

Given these insights, the question arises about how different forms of mobility and usage durations specifically affect emotional attachment to cars and what other factors are relevant in this context. This dissertation thus aims to a) expand the understanding of emotional attachments to cars (e.g., relevant emotions and development over time) by identifying influencing factors for this attachment (e.g., user group or car characteristics) and b) develop and test approaches to foster a positive attachment to the car.

1.2 Theoretical background of emotional product attachment

According to Schifferstein and Zwartkruis-Pelgrim (2008), emotional product attachment describes "the strength of the emotional bond a consumer experiences with a durable product" (p. 1). This strength is product-specific and person-dependent (Karapanos et al., 2009). Individuals can form strong attachments to certain products

but not to others (Kleine & Baker, 2004; Schultz et al., 1989). Products to which an emotional attachment is built are considered as special and meaningful for the user (Mugge et al., 2008).

Ko et al. (2015) argue that attachment arises when there is a strong commitment and intense emotions towards the product. These emotions are predominantly positive, except for sadness, which is often triggered by associated memories (Schultz et al., 1989). Products lacking emotional attachments typically do not elicit strong emotional responses (Schultz et al., 1989). To build an emotional attachment to a product, the product must provide the user additional value beyond its functional utility (Mugge et al., 2006).

As a result of emotional attachment, users show higher brand loyalty and satisfaction (Schau et al., 2009). Moreover, they attempt to extend the product's lifespan, try to repair the product, and avoid its replacement as long as possible (Schifferstein & Zwartkruis-Pelgrim, 2008). It is also possible to develop a functional attachment to a product in which the product is primarily valued for its pragmatic aspects (e.g., a washing machine). In contrast to an emotional attachment, objects with a functional attachment are easier to replace as they do not have a special meaning to the user that makes them irreplaceable (Mugge et al., 2006).

The definitions given above have similar implications for emotional product attachment:

1. The intensity of product attachments is product-specific as well as person-dependent.
2. Emotional attachments occur together with predominantly positive emotions. Therefore, emotions are part of an emotional attachment.
3. A personal relationship exists between the individual and the object of attachment.

Various theoretical models discussed in the following chapter explore the development of emotions through products and/or emotional product attachments. Based on the implications of the definition of product attachment, these models can be broadly categorized into two groups. On the one hand, there are models focusing on the emotions elicited by products. On the other hand, some examine how specific

product characteristics lead to emotional attachments. First models belonging to the former category are presented, followed by those in the latter.

1.2.1 Emotions elicited by products

One model in the field of product design and human-product interaction is Norman's emotional design model. Norman (2005) proposes a model that differentiates between three levels of emotional processing in response to products:

- The **visceral level** involves immediate, instinctive reactions triggered by the appearance and feel of a product.
- The **behavioral level** focuses on the joy and satisfaction arising from the usability and functionality of a product.
- The **reflective level** encompasses a product's deeper meaning and symbolic value, which is shaped by personal memories, cultural associations, and individual values.

Norman's model has positively influenced the design of products and, by this, the interaction between humans and products, but there are also some critics. The model is very simplified and overlooks the complexity of relationships and the individuality of users' perceptions (Boyatzis, 2018; Grayot, 2019). For example, what is viscerally appealing to one user may seem uninteresting to another. Additionally, Norman's model does not consider the context in which a product is used and the emotions it generates (Boyatzis, 2018). Furthermore, no measurements on how to capture these levels are suggested.

Whereas Norman focuses on emotional reactions to products, Jordan (2000) considers how products generate pleasure and satisfaction. He explores how products can be designed to be not only functionally and aesthetically pleasing but also psychologically satisfying. Jordan (2000) describes four different types of pleasure that users can experience through products:

- **Physio-pleasure** refers to sensory pleasures, such as touching a soft fabric.
- **Socio-pleasure** encompasses the joy derived from social interactions and relationships, for example, sharing a product with friends.
- **Psycho-pleasure** results from cognitive stimulation, such as solving a puzzle.

- **Ideo-pleasure** pertains to the pleasure derived from the values and meanings conveyed by a product, such as an environmentally friendly design.

Jordan's model considers the social context of product use and the deeper, subjective interpretation and personal meanings that individual users assign to these experiences. However, it exclusively regards pleasure as the primary emotional response. This overlooks the broader range of emotions that products can evoke, including negative emotions, which are also crucial for understanding individual experiences (Desmet, 2002; Schultz et al., 1989). Like Norman, Jordan does not provide specific methods for measuring emotional responses.

Desmet (2002) considers both positive and negative emotions. He considers emotions as the result of an appraisal process in which the characteristics of a product are compared to the individual concerns of the user (e.g., goals, norms, attitudes). A match leads to positive emotions (e.g., satisfaction), while a discrepancy triggers negative emotions (e.g., disappointment). Desmet identified several relevant emotions in this context and developed the non-verbal tool PrEmo2 (Laurans & Desmet, 2017) to capture them. Therefore, cartoon animations show various positive (amusement, admiration, pride, hope, satisfaction, fascination, desire) and negative emotions (sadness, fear, shame, contempt, dissatisfaction, boredom, disgust) elicited by a product. Participants select one or more cartoon animations that express their emotions resulting from the product.

However, the occurrence of emotions does not necessarily mean that the user also forms an emotional attachment to the product (Bettiga et al., 2020). Additionally, the models previously examined overlook product-specific influences on the development of emotions. The following passages will introduce models that concentrate primarily on product characteristics and their role in fostering emotional product attachment.

1.2.2 Product characteristics and their role in emotional product attachments

Hassenzahl (2005) introduced a well-established framework to differentiate between pragmatic and hedonic product qualities. Both influence the overall evaluation of the product. Pragmatic qualities support the immediate achievement of product-related goals ("do-goals"). They are considered as 'hygiene factors'. This means their presence is expected and does not directly lead to a positive usage experience, but their absence is perceived negatively. Hedonic qualities contribute to aesthetic and

meaningful experiences and support the goal of how users want to be perceived (“be-goals”). They are considered 'motivators' that directly influence positive experiences and can thus also lead to an emotional attachment (Diefenbach, 2012). Hedonic qualities include:

- **Identification**: This refers to the user’s tendency to assign personal value to a product and use it for self-expression and social communication.
- **Evocation**: This pertains to a product’s ability to evoke personal memories and expectations.
- **Stimulation**: This describes the user’s motivation to interact with the product, which arises from its novelty and the associated curiosity and excitement.

Several methods are established to assess perceived pragmatic and hedonic quality, such as the AttrakDiff by Hassenzahl et al. (2003) and the User Experience Questionnaire (UEQ) by Laugwitz et al. (2008). Both questionnaires assess the valence of pragmatic and hedonic product qualities. This is achieved using semantic differentials, where opposing items are presented, and participants express their tendency towards each item on a seven-point scale.

Hassenzahl (2005) distinguishes between pragmatic and hedonic product qualities with his model. Although hedonic qualities are crucial for developing emotional attachments, Hassenzahl (2005) does not explicitly analyze these attachments. Mugge (2007) examines the concept of emotional attachment and its underlying determinants in more detail. Mugge thus breaks down the psychological mechanisms that lead to strong product attachment. Some of his four determinants partially overlap with Hassenzahl’s hedonic aspects, creating a notable connection between the two models. Mugge’s (2007) determinants include:

- **Memories**: Products can serve to preserve the past. Users form stronger attachments to products that remind them of specific people or events (Schultz et al., 1989; Wallendorf & Arnould, 1988). This determinant corresponds to Hassenzahl’s evocation.
- **Pleasure**: Pleasure describes the extent to which users experience enjoyment, happiness, and satisfaction through the product. Previous research confirms the link between pleasure and product attachment (e.g., Davis, 2002). Pleasure can be categorized under Hassenzahl’s stimulation.

- **Self-expression**: Users may seek to differentiate themselves and express their identity through product acquisition, presentation, and use. Products thus acquire symbolic meaning for the user. Previous research confirms that users develop a stronger attachment to products through which they can express their unique and personal identity (Schultz et al., 1989; Wallendorf & Arnould, 1988). Self-expression can thus be considered as part of Hassenzahl's identification.
- **Group affiliation**: This determinant is based on the need for social connectedness and belonging. Products that strengthen ties to family members, friends, or social groups gain emotional attachments for the user (Schultz et al., 1989; Wallendorf & Arnould, 1988). As these products represent the social self, group affiliation can also be considered as part of Hassenzahl's identification.

Mugge et al. (2005) developed the Product Attachment Scale (PAS) to measure the extent of product attachment based on the determinants described above. The participants express their agreement on a seven-point scale. Although Mugge (2007) explicitly considers product attachment and proposes a questionnaire for measuring it, not as much research has been done on his model as on Hassenzahl's (2005).

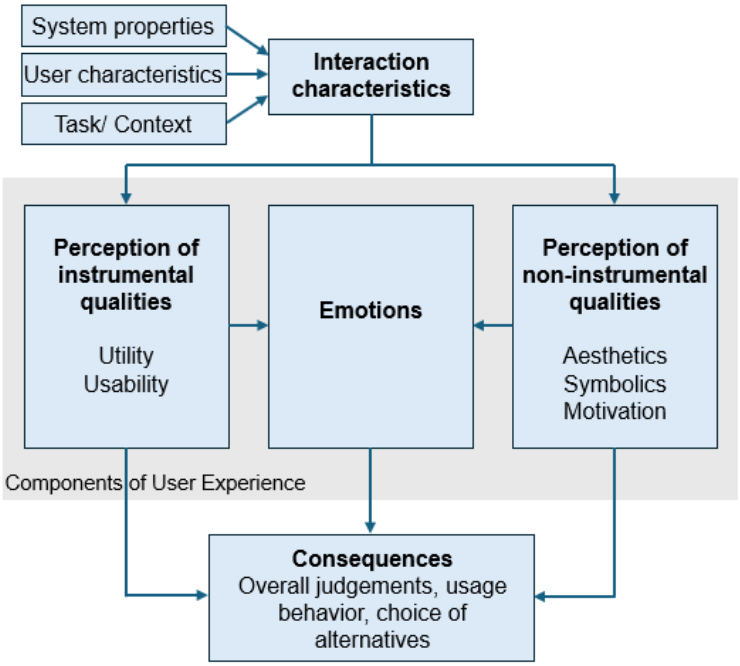
The Component Model of User Experience (CUE), as proposed by Thüring and Mahlke (2007), provides a framework to connect product qualities, emotions, and the consequences of User Experience (UX). UX is "a person's perceptions and responses that result from the use or anticipated use of a product, system or service" (Deutsches Institut für Normung e. V., 2020, ISO 9241-210, p.3). As depicted in Figure 1, the CUE divides the user experience into three components:

- **Perception of instrumental qualities**: includes usability and utility, comparable to Hassenzahl's pragmatic qualities.
- **Perception of non-instrumental qualities**: encompasses aesthetic attributes that describe sensory experiences, as well as symbolic attributes that involve personal meaning, reflection, and the expression of belonging or personal values through the experienced interaction. Motivational attributes, related to self-regulation and agency, also belong to this category and correspond to Hassenzahl's hedonic qualities.

- **Emotional user response**: This is influenced by the perception of both instrumental and non-instrumental qualities.

Figure 1

Component Model of User experience according to Thüring and Mahlke (2007)



All three UX components affect the product's overall evaluation and thus influence acceptance, usage intention, and usage behavior. The perception of instrumental and non-instrumental qualities is, in turn, influenced by interaction characteristics. These result from the properties of the system (e.g., functionality and interface design), the user (e.g., knowledge and skills), and the specific task in a certain context. Although product attachment is not explicitly considered in this model, it can be regarded as a consequence of the user experience: Considering the definitions of emotional product attachment (see Chapter 1.2), it is reflected in the overall judgment (e.g., users consider the product as special), usage behavior (e.g., users attempt to extend the product's lifespan), and the choice of alternatives (e.g., brand loyalty).

The models presented so far do not explicitly consider the temporal component. Therefore, the following section will examine this in more detail.

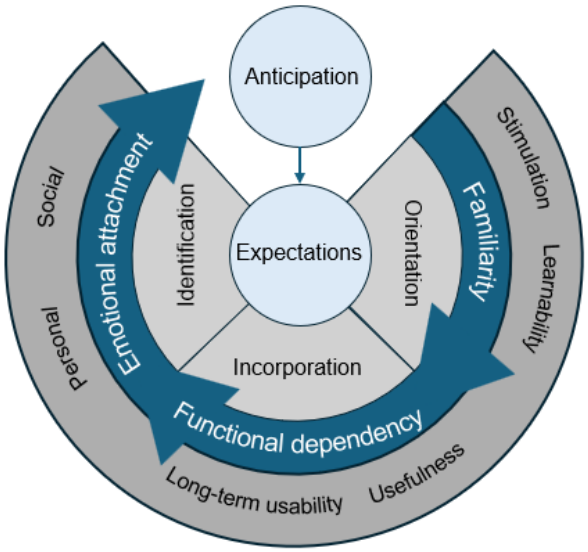
1.3 Temporal aspects of product attachment

Bardhi and Eckhardt (2012) and Norman (2005) acknowledge that repeated interactions with a product over time foster emotional attachments. Nevertheless, how these emotions and attachments evolve over time is often neglected.

Karapanos et al. (2009) conducted a long-term study with six mobile phone users over four weeks. The users were asked to evaluate the mobile phone in the first week of usage and after the fourth week. The results reveal that the perceived importance of different product qualities changed across the usage period. This led to developing a model depicting the temporal phases of user experience, as illustrated in Figure 2.

Figure 2

Model of temporality of experience adapted from Karapanos et al. (2009)



Karapanos et al. (2009) identified three primary usage phases: Orientation, Incorporation, and Identification. Additionally, an Anticipation phase was introduced to capture pre-use expectations. Transitions between these phases are influenced by three forces: familiarity, functional dependency, and emotional attachment.

1. **Orientation:** This phase is characterized by the user's initial experiences and includes excitement from stimulation and frustration if the product's learnability is challenging. As familiarity grows, both learning challenges and stimulation diminish.

2. **Incorporation:** In this phase, the product is integrated into daily life. The product's usefulness and long-term usability shape user experiences, leading to functional dependency.
3. **Identification:** In this phase, the product is used to communicate one's identity, to distinguish oneself from others, or to show belonging to a particular group. The product becomes a personal object and is integrated into private and social contexts. This leads to the user forming a personal attachment to the product. Karapanos et al. (2009) also highlight that it is unclear how emotional attachment develops to products that are not involved in users' personal and social lives.

Further research on the temporal changes in the perception of product qualities can be found in Hassenzahl (2005). He describes stimulation as particularly important at the beginning due to the novelty effect of the product, meaning the initial excitement and heightened engagement that derives from experiencing something new. This aligns with Pettersson (2012), who emphasizes the initial impression of a product as particularly formative. This effect diminishes over time when the product is no longer new (Hassenzahl, 2005). This aligns with the findings of Schäppi et al. (2005), who suggest that initially exciting product features become basic attributes over time. This occurs as users become accustomed to these features, wear and tear become visible, or the user has explored all functions and desires new ones. In contrast, identification with the product and evocation increase over time, while the perception of pragmatic qualities remains relatively constant (Hassenzahl, 2006; Wilamowitz-Moellendorff et al., 2007).

Mugge et al. (2005) also support that the degree of product attachment changes over time through the addition or loss of attachment determinants. For example, more memories are accumulated with the product throughout its use, and identification increases. Since product-related memories are positively associated with product attachment, the attachment increases. However, the influence of these memories can diminish if the user does not interact with the product regularly (Mugge et al., 2005).

1.4 The current dissertation

Although research in other product areas (e.g., mobile phones) has shown emotions and emotional attachments influence product decision-making, investment, and usage

(Hassenzahl & Diefenbach, 2017), research within the automotive context has primarily focused on functional aspects of cars, such as fuel efficiency and safety. There is limited research on the emotions and deeper emotional attachments users form to their cars.

The initial user forum posts also illustrate a spectrum of emotions, from happiness to sadness. The literature highlights that emotional attachment involves predominantly positive emotions (Ko et al., 2015; Schultz et al., 1989), but also acknowledges that negative emotions like sadness can be associated with cherished objects (Schultz et al., 1989). Also, Desmet's (2002) theory emphasizes the range of both positive and negative emotions elicited by products. Therefore, it is crucial to identify the most relevant emotions in the automotive context to understand emotional attachments to cars. Thus, the first research question (RQ) is:

1. *Which emotions are relevant in the context of cars?*

Several models point to the influence of product characteristics on UX and emotional attachment. Norman's (2005) model discusses visceral (appearance and feel), behavioral (usability and functionality), and reflective (meaning and symbolic value) levels. Hassenzahl's (2005) pragmatic and hedonic qualities directly relate to how car features can resonate emotionally with users. Also, Thüring and Mahlke (2007) distinguish between instrumental and non-instrumental qualities that influence emotions and emotional attachment. Investigating which car characteristics align with these theoretical constructs will provide valuable insights. Therefore, the second RQ is:

2. *Which characteristics of the car are relevant for an emotional attachment?*

Mugge (2007) explicitly outlines four determinants of emotional product attachment: memories, pleasure, self-expression, and group affiliation. Existing research highlights the role of memories, noting that users form stronger attachments to products that remind them of specific people or events (Schultz et al., 1989; Wallendorf & Arnould, 1988). Research on cars as extensions of self (Mugge et al., 2010) and symbols of status and independence (Sheller & Urry, 2000) supports the relevance of self-expression and potentially group affiliation (through shared experiences or brand identity). Therefore, the third RQ aims to validate and potentially expand upon these determinants within the specific domain of cars:

3. *What determinants of emotional attachment are relevant in the context of cars?*

The model of the temporality of user experience from Karapanos et al. (2009) explicitly addresses how user perceptions and potentially emotional attachments evolve through orientation, incorporation, and identification phases. Hassenzahl (2005) and Schäppi et al. (2005) discuss how the novelty and the perception of pragmatic and hedonic product qualities change over time. Mugge et al. (2005) also note the temporal dynamics of attachment determinants like accumulated memories. Given many individuals' extended duration of car ownership, understanding this temporal evolution is crucial. Thus, the fourth RQ is:

4. *How does the emotional attachment and emotions to the car develop over time?*

Literature acknowledges that attachment is person-dependent (Karapanos et al., 2009; Kleine & Baker, 2004; Schultz et al., 1989). Different forms of car usage (e.g., owning, leasing, car sharing, and renting) exist. Initial studies suggest that ownership status and usage duration can influence emotional attachment (Bardhi & Eckhardt, 2012; Fraine et al., 2007; Schaefers, 2013). Exploring differences across various user groups will refine our understanding of the factors influencing car-related emotions and attachments. Therefore, the fifth RQ is:

5. *What differences exist between the user groups?*

Understanding the relevant emotions, car characteristics, and attachment determinants, as well as their development over time and across user groups, has practical implications for automotive manufacturers, marketers, and policymakers. As emotional attachments influence purchasing decisions, brand loyalty (Schau et al., 2009), and even the willingness to consider alternative mobility (Steg, 2005), exploring strategies to foster positive attachments becomes relevant. The sixth question directly builds upon the findings of the previous research questions to explore potential applications of the theoretical understanding:

6. *How can an emotional attachment to the car be fostered?*

Six studies were conducted within the dissertation to address the RQs, and they are presented in four papers (including one already published (paper 3), one accepted (paper 4), and two currently in revision (papers 1 and 2). Table 1 provides a detailed overview of the specific RQs examined in each paper.

Table 1

Contributions of the individual studies to answering the research questions (RQ)

	Paper 1	Paper 2	Paper 3	Paper 4
RQ 1	X	X	X	
RQ 2	X	X		
RQ 3	X	X		
RQ 4	X	X	X	
RQ 5	X	X	X	X
RQ 6			X	X

The study presented in Chapter 2 (paper 1) provides initial exploratory insights into RQ 1 to 5. This study explored relevant emotions, the car's unique characteristics, determinants of attachment, and how this attachment develops over time across different user groups. For this purpose, semi-structured interviews were conducted with owners, lessees, car sharing users, and renters. A mixed-methods approach was applied, containing open qualitative questions and quantitative questionnaires such as the PrEmo2 or PAS. The results suggested differences in the strength and qualities of emotional attachments between the different user groups. Since it was found that renters do not develop an emotional attachment to the car, they were not considered in further studies. Additionally, four usage phases of the car were identified, leading to emotional attachment changes.

Chapter 3 (paper 2) presents three online studies. They built on the findings from the first study with quantitative data. Therefore, large heterogeneous samples were asked about their emotions, the special features of the car, and their attachment to the car. Additionally, differences in emotional attachment between users of premium and volume cars were examined. An inter-individual, cross-sectional approach gained insights into the dynamics of emotional attachment.

In focus groups in Chapter 4 (paper 3) with owners, lessees, and car sharing users, the emotional characteristics of the use phases identified in Chapter 2 were discussed in depth and supplemented with ideation exercises to generate initial ideas on how users can be emotionally supported in the respective use phases. The car change, i.e., the farewell to the previous car and the receipt of the upcoming car, was particularly emotional.

Chapter 5 describes the conceptualization process of a mid-fidelity prototype aiming to facilitate the car change emotionally. Therefore, the ideas developed in Chapter 4 were thoughtfully expanded and refined through iterative, strategic considerations. Finally, two mid-fidelity prototype variants were developed. One variant focused on preserving memories of the previous car, while the other sought to stimulate anticipation for the new one.

In Chapter 6 (paper 4), this prototype was tested with both users with and without emotional attachment to the car. In particular, it was examined to what extent the storage of memories (memories/ evocation) or the stimulation of anticipation for the upcoming car (pleasure/ stimulation) emotionally facilitates the car change. A mixed-methods approach was applied through semi-structured interviews, including open qualitative questions and quantitative measurements like the PAS or UEQ.

In the general discussion in Chapter 7, the results from all studies are synthesized and interpreted in the context of the existing literature. Limitations and future research directions are discussed. Finally, implications for practical strategies to promote emotional attachment to the car are derived.

Please note that Chapters 2, 3, 4, and 6 are structured as separate papers that can be read independently. As the predictions derived in these chapters build upon similar theoretical assumptions, they may show some content overlap.

2. The Emotional Attachment between Humans and their Cars: Dimensions, Dynamics, and Implications

Author	Author position	Scientific ideas %	Data generation %	Analysis & interpretation %	Paper writing %
Mareike Grund	1	90	100*	90	90
Ingo Totzke	2	10	0	5	5
Arnd Engeln	3	0	0	5	5
Title of paper:		The Emotional Attachment between Humans and their Cars: Dimensions, Dynamics, and Implications			
Status in publication process:		submitted			

* Recruiting of participants and moderating the study were carried out by Move Research GmbH.

Abstract

The attachment to a car goes beyond its functional utility and can evoke emotions in the user, which may change over time. Due to the increasing diversity of mobility concepts, this study included various user groups (n = 9 owners, n = 10 lessees, n = 10 car sharing users, n = 7 renters). Using a mixed-methods approach, this study examines the emotions, determinants of emotional attachment, reasons for it, and its development over time. The results reveal varying degrees of attachment among user groups: owners show the strongest attachment, followed by lessees, car sharing users, and renters. For owners and lessees, memories with the car play a central role, with lessees also valuing good equipment and a large car. Car sharing users develop a more pragmatic attachment but take pride in leading a sustainable and socially responsible lifestyle. Renters hardly develop a long-term attachment due to the temporary nature of their usage. The study further identifies four distinct use phases, each characterized by specific emotional patterns: familiarization, everyday use, dealing with malfunctions and defects, and farewell. This study offers implications for the automotive industry by enabling the development of more effective marketing strategies and products tailored to the unique emotional attachments of different user groups. This can lead to enhanced customer satisfaction and increased brand loyalty. Moreover, this study extends the existing knowledge on emotional product attachment, providing valuable insights for both theoretical understanding and practical applications.

2.1 Introduction

The car dominates motorized personal transport, and the number of cars continuously increases. More car manufacturers are entering the market, intensifying competition (Puls, 2024). This leads to pressure for innovation to differentiate from competitors. These innovations primarily focus on enhancing driving safety and comfort. It is often overlooked that the car is not only a means of transportation but also connected to deeper needs and emotions (Eckoldt et al., 2013; Hassenzahl, 2018; Steg, 2005). Fu (2024) has shown that affective attitudes, which are emotions and feelings evoked by the car, significantly influence car travel behavior. Rational considerations play a subordinate role in this context. The car holds a unique place in our lives, often leading to emotional attachments (Sheller, 2004; Steg, 2005). It facilitates participation in various aspects of our lives and enables activities such as weekend trips, daily commutes, and social visits (Kent, 2014; Stanley et al., 2011; von Behren et al., 2021). Moreover, the car provides convenience through its speed, flexibility, and safety features (Kent, 2014; Steg, 2005). The thrill of the drive, the discovery of new destinations, and the constant evolution of automotive technology contribute to a sense of stimulation (Gkouskos et al., 2015). Beyond these aspects, the car plays a crucial role in shaping memories and identities. Shared experiences during car journeys create lasting memories (Steg, 2005).

Furthermore, the car itself becomes a reflection of the users' personality and social standing. The choice of car and its customizations often serve as a means of self-expression and social positioning (Belk, 1988). The car can symbolize success, freedom, and social status, influencing how others perceive the user (Belk, 1988). Thus, in addition to its pragmatic functions, the car also fulfills affective and symbolic functions (Steg, 2005).

Further research has examined various user groups with differing car usage and ownership models. While car ownership typically involves long-term use (Instamotion, n.d.), leasing contracts are shorter, and the users do not own the car (Leschau & Baumgarten, 2024). Car sharing users access cars on demand for specific purposes without permanent ownership. These cars are typically reserved for short periods, often just a few hours. In contrast, rental cars are usually booked for longer periods, such as a full day or more.

Fraine et al. (2007) examined the relationship between drivers and their cars, focusing on owners and drivers of work vehicles, such as taxi drivers. According to them, the car was often described as a protective space, a repository of personal memories, and an object of personal expression. This indicates that the car is considered as primary territory regardless of ownership status.

Conversely, Bardhi and Eckhardt (2012) argued that temporary car use hinders the development of a strong attachment. They found that car sharing users, unlike owners, rarely develop a sense of ownership or identification with the car. Car sharing users see their relationship with the car as more utilitarian and less emotional. They prioritize the car's utility, even if they use it to communicate a sustainable and social lifestyle through it (Schaefers, 2013).

2.1.1 Emotional product attachment

This study considers two relevant models: one describes various product qualities, and the other addresses emotional product attachment. The first model, proposed by Hassenzahl (2005), categorizes product qualities into two dimensions: pragmatic and hedonic. Pragmatic qualities, such as usability and utility, directly support task completion. Hedonic qualities enhance emotional user experiences and include the following:

- Stimulation, which triggers emotions through novelty and excitement,
- Evocation, which elicits personal memories and emotions, and
- Identification, which allows users to express their individuality through the product (Hassenzahl, 2005).

Both qualities shape product evaluation and attachment by contributing to an overall judgment of a product's attractiveness. According to Winder (2006), there is a significant correlation between the prominence of hedonic qualities and the level of emotional attachment to a product. This attachment can lead to behavioral changes, such as more frequent use, and emotional responses, including pleasure and satisfaction (Sandweg et al., 2000).

The second model is Mugge's (2007) model of emotional product attachment, which partially aligns with Hassenzahl's (2005) model. Mugge identified four determinants crucial to fostering emotional attachment between users and products:

- Pleasure: This refers to the positive feelings and immediate enjoyment users experience while interacting with a product. Hassenzahl (2005) does not explicitly mention pleasure in his model. However, stimulation can be seen as part of it.
- Memories: This captures the product's ability to elicit positive memories and emotions in the user, which parallels Hassenzahl's (2005) dimension of evocation.
- Self-expression: This determinant refers to users' desire to differentiate themselves and convey their personality through a product. It corresponds to Hassenzahl's (2005) concept of identification.
- Group affiliation: This relates to the user's need to feel a sense of belonging to a social group and to gain respect and acceptance through the use of the product. While not directly represented in Hassenzahl's (2005) model, it can be seen as an aspect of the concept of identification.

2.1.2 Importance of time for product attachment

Product quality perceptions are dynamic and change over time. Hedonic qualities exhibit greater variability compared to pragmatic qualities, which tend to remain more stable (e.g., Wilamowitz-Moellendorff et al., 2007). Kujala et al. (2011) suggested that the most notable change in a product's appeal occurs during its initial usage phase. This is consistent with Pettersson's (2016) findings that first impressions are crucial for developing long-term product loyalty. Prior to and during the initial use phase, users experience anticipation and form expectations about the product. The novelty of a product can lead to curiosity and excitement about its features, stimulating pleasure within the user (Hassenzahl, 2005). The novelty effect may diminish over time as users become accustomed to the product. This habituation can potentially lead to a decline in perceived attractiveness unless it is maintained through other methods, such as regular updates (Hassenzahl, 2006). However, the number of product-related memories and the level of identification with the product increase over time, making users more familiar with it (Hassenzahl, 2006). This may also enhance the product's perceived attractiveness (Karapanos, 2013). Frequent interactions, positive associations, and memories foster long-term positive emotions towards a product (Norman, 2005). There is a positive correlation between product-related memories and attachment, which can strengthen product loyalty over time (Mugge et al., 2005).

2.1.3 Study objectives

Despite the acknowledged importance of emotions in product choice and attachment, the role of emotions in the context of cars remains largely unexplored. While it is known that cars transcend their pragmatic functions and can evoke emotions in users (Steg, 2005), there is a lack of systematic investigation into the relevant emotions, emotional attachment, and hedonic qualities. Our study addresses this research gap by identifying the specific emotions relevant to cars and examining the determinants of product attachment and hedonic qualities essential for developing an emotional attachment. Furthermore, we investigate which car attributes elicit emotions and how emotional attachment evolves over time. We explicitly examine the phase of the car farewell. Although this phase occurs in nearly every product lifecycle, it remains underexplored. By considering different user groups (owners, lessees, car sharing users, and renters) and their varying usage patterns, we can also demonstrate the complexity of emotional attachment to cars in different contexts.

This study provides new insights into the role of emotions in the context of attachments to cars. We extend existing knowledge by not only identifying relevant emotions and their triggers but also examining the dynamic nature of this attachment over time and across different user groups. The findings of our research have the potential to provide valuable insights for the automotive industry. These insights could inform the development of cars that foster stronger emotional attachment, leading to higher user satisfaction and brand loyalty. Additionally, our results offer valuable suggestions for fleet providers of car sharing or rental cars to enhance the emotional experience of their customers. This, in turn, can increase the usage, enjoyment, and competitiveness of these providers. Thus, our study contributes not only to research advancement but also provides practical recommendations for the industry.

2.2 Methods

2.2.1 Research design

A mixed-methods design was employed. The qualitative approach provided an in-depth understanding of participants' emotions and behaviors. Therefore, semi-structured online interviews were conducted, supplemented by quantitative questionnaires. The quantitative approach was used to identify statistically significant effects. An experienced interviewer conducted all interviews. The independent variable

'user groups' distinguished among car owners, lessees, car sharing users, and renters. This classification was based on selective questions during recruitment to obtain approximately equal-sized groups. As it was a semi-blind procedure, participants were unaware that different groups were being considered.

2.2.2 Measurements

Self-Assessment Manikin (SAM) Scale. The SAM scale (Bradley & Lang, 1994) is a nonverbal pictorial assessment technique utilizing a 9-point scale with cartoon representations. This scale was used to measure emotional assessment along the dimensions of valence (unhappy - happy) and arousal (calm - stressed) separately regarding the car. The dominance scale was omitted as it was not relevant to this study.

Product Emotion Measurement Instrument (PrEmo2). The PrEmo2 by Laurans and Desmet (2017) is another non-verbal pictorial assessment technique that assesses emotions associated with a product through cartoon animations. It captures seven positive emotions (amusement, admiration, pride, hope, satisfaction, fascination, desire) and seven negative emotions (sadness, fear, shame, contempt, dissatisfaction, boredom, disgust). Participants expressed their emotions towards their car by selecting one or more cartoon animations.

Product Attachment Scale (PAS). The PAS by Mugge et al. (2005) measures product attachment on a 7-point Likert scale ranging from 'strongly disagree' (1) to 'strongly agree' (7) based on the determinants: memories, pleasure, self-expression, and group affiliation. The items were translated into German and adapted to the automotive context. Participants received the items in a randomized order. Table 2 lists the English items and Cronbach’s alpha for each determinant. The internal consistency across all determinants was strong to excellent, except for group affiliation, which exhibited questionable internal consistency.

Table 2

Items of the Product attachment scale and Cronbach's alpha

Determinant	Cronbach's α	Item (translated to English)
Product attachment	.92	I am very attached to my car My car has no special meaning to me* My car is very dear to me I have a bond with this car
Memories	.97	My car reminds me of people or events that are important to me My car makes me think back of someone or something that has happened I see my car as a reminder of certain people or events Through my car I think back to certain people or events
Pleasure	.79	I enjoy my car It is a pleasure to use my car I feel good when I use my car
Self-expression	.79	My car reflects who I am Other people can tell by my car what kind of person I am My car fits my identity My car suits me My car says nothing about means an individual*
Group affiliation	.60	My car indicates that I am a car owner Through my car I feel connected to other car owners Through my car I belong to the group of car owners

Note. * Indicates a reversed item

Inclusion of other in the self (IOS) scale. To assess the degree of closeness between the participant and their car, we employed the Inclusion of Other in the Self (IOS) scale developed by Aron et al. (1992). This single-item measure presents seven pairs of circles overlapping to varying degrees. The circles ranged from two separate circles that only touched (1) to two circles that were almost completely overlapping (7). The closer the attachment, the more the circles overlap. One circle was labeled as 'self' and the other was labeled as 'car'. Participants were asked to choose the option that best describes their attachment to their car.

UX Curve. The UX Curve by Kujala et al. (2011) allows users to retrospectively report how and why their experience with a product has changed over time. Participants receive a template with an empty two-dimensional graph space. The horizontal axis represents the time from the first contact with the product to the current

moment, which means the depicted time span can range from a few weeks (e.g., for renters) to several years (e.g., for owners). The vertical axis represents the valence of the user's experience and is labeled with 'very positive', 'positive', 'neutral', and 'negative'. In this study, participants were asked to express their attachment by drawing a curve and briefly describing the reasons for changes in the curve.

2.2.3 Recruiting and participants

Participants were recruited from four different user groups: owners, lessees, car sharing users, and renters. The participants were contacted by email and asked about the inclusion criteria by an independent agency. As inclusion criteria, all participants were required to use the car regularly (for owners and lessees: at least 5,000 km/year; for car sharing users and renters: at least once a month). Car sharing users were required to use station-based car sharing, thus frequently using the same car. Additionally, owners and lessees were required to have an emotional attachment to their car. Emotional attachment was assessed using self-developed questions. Participants were given seven items and asked to express their agreement on a 4-point Likert scale ranging from 'strongly disagree' (1) to 'strongly agree' (4). The items included statements such as "I simply love this car" or "I primarily see my car as a means of transportation" (inverted). Participants had to score 3 or 4 on at least five questions (or 1 or 2 on inverted questions) to be included in the study. Cronbach's alpha of .73 for positive affect indicates that the questionnaire's internal consistency is between acceptable and good. Additionally, participants were required to speak German fluently.

The final sample consisted of $N = 36$ participants (owners: $n = 9$, lessees: $n = 10$, car sharing users: $n = 10$, renters: $n = 7$). Table 3 shows the distribution of age and gender across user groups.

Table 3

Means (M) and standard deviation (SD) of age and gender distribution per user group

User group	Age		Gender	
	M	***SD***	**Female**	**Male**
Owning	38.56	11.52	5	4
Leasing	40.7	14.16	5	5
Car sharing	42.5	9.36	5	5
Renting	44.71	13.11	1	6
Overall	41.44	11.58	16	20

Interviews were conducted via MS Teams in November 2021, each lasting approximately 60 minutes. With participants' consent, all interviews were recorded for data analysis. Participants could withdraw from the study at any time without facing negative consequences. No ethical concerns were identified.

2.2.4 Procedure

Participants and the interviewer, who was experienced in conducting semi-structured interviews, joined the MS Teams meeting through an email link provided by an independent agency. After confirming technical functionality, participants were briefed on the study's topic and procedures.

They introduced themselves and spoke about the car model they own, lease, regularly use in car sharing, or have frequently rented. Furthermore, they were asked how long they had already been using the car and for what reasons they used it. Car sharing users and renters were also asked how often they booked the car. Participants then used the SAM scale to express their valence and arousal levels and the PrEmo2 tool to select emotions associated with their car. The interviewer shared her screen to display the scales. Furthermore, the interviewer asked follow-up questions about the origins and expressions of these emotions. Afterwards, participants were asked what made their car special, their criteria for choosing it, any significant experiences, and how it differed from other cars they had owned. The participants were also asked if they had ever owned a car they liked more and if they knew anyone more attached to their car, and how this was evident.

Participants then completed the PAS and IOS scales for the car they discussed in the study. They were given control to navigate the PAS document independently while

the IOS scale was completed verbally. Next, participants were shown the UX Curve template and given control to plot their relationship with the car from first contact to the present. The participants were asked to think aloud and describe and note specific emotions and reasons for changes in the curve. To gain insights beyond the current usage period, participants were asked about their car farewell experience, the emotions they experienced, and strategies to mitigate negative feelings. The session concluded with thanks for their participation. The exact questions are shown in Appendix A.

2.2.5 Data analysis

The data obtained from the SAM, PAS, and IOS scale were prepared and initially analyzed using descriptive statistics with the assistance of Microsoft Excel 2016 and IBM SPSS Statistics (Version 27). Subsequent inferential statistical analyses involved comparisons of means between the independent variable 'user group' (owning, leasing, car sharing, renting). When appropriate, a one-way Analysis of Variance (ANOVA) was conducted. While ANOVA is generally robust against violations of normality (Vasey & Thayer, 1987), the assumption of homogeneity of variances was carefully examined. If this assumption was violated, a Welch's ANOVA was conducted instead. Tukey's HSD test was used for post-hoc comparisons.

To evaluate the PrEmo2, we used a chi-square test to compare the frequencies of positive and negative emotions, ensuring that the test's assumptions were met.

We adopted the methodology proposed by Kujala et al. (2011) to analyze the UX curves, categorizing curve trends as improving, deteriorating, or stable. The rationales provided for curve changes were analyzed inductively, employing Hassenzahl's (2005) model for coding. We quantified the frequencies of hedonic and pragmatic reasons cited for curve changes. A chi-square test was then conducted to assess the statistical significance of these findings.

Audio recordings of all sessions were transcribed verbatim and cross-referenced with observer notes to analyze the open-ended responses. Each participant was assigned a unique identifier to maintain confidentiality, such as 'P1-1', where the first number indicated the user group (1 – owning; 2 – leasing; 3 – car sharing; 4 – renting) and the second number distinguished between the participants within the user group. Qualitative data analysis was conducted using MAXQDA software (VERBI Software,

2018). The qualitative content analysis adhered to the principles outlined by Kuckartz (2016). A combination of deductive and inductive elements was employed for coding and categorization. An initial category system was developed based on the thematic blocks from the semi-structured interview guide and the product quality dimensions proposed by Hassenzahl (2005). This initial system was then refined through inductive analysis of relevant text passages. New categories were added if needed, and a hierarchical structure of the categories was developed. This iterative process continued until theoretical saturation was reached, meaning no further changes to the categorization system were necessary. An experienced student assistant developed a category system independently to enhance inter-rater reliability. Subsequently, both category systems were compared, and any discrepancies were discussed and resolved through consensus. The second author reviewed the final category system.

Regarding the emotions evoked by the car and its special characteristics, we quantified the frequency of each category. We adjusted these counts relative to the size of the respective user group to enable comparisons across groups. Additionally, the categories of special features were organized according to Hassenzahl's product qualities. The statements regarding car farewell were coded as positive, neutral, or negative. Additionally, negative statements were ranked by intensity. A chi-square test was employed to assess the statistical significance of frequency differences if the test's assumptions were met.

All quotations in this paper were translated from the original German.

2.2.6 Quality criteria

This study employed established qualitative research methodologies for data collection and analysis. To enhance the *credibility* of the findings, we followed the principles of qualitative data analysis outlined by Miles and Huberman (1994). Throughout the research process, a second experienced researcher participated in all stages, including planning, implementation, and analysis, to ensure objectivity. The interviewer possessed expertise in conducting mixed-method interviews. The voluntary participation of all participants enabled an open and honest discussion environment. A consistent approach to data collection was maintained to enhance the study's *dependability*. A detailed interview guide addressed all relevant topics during each interview, ensuring a standardized process while allowing for individual variation.

To enhance *confirmability*, all interviews were recorded and documented. Researchers regularly exchanged information and documented each step of the analysis process. Including direct quotes from participants enhances the richness and comprehensiveness of the findings. The research design, data collection methods, and analysis procedures are transparently described to ensure *transferability*.

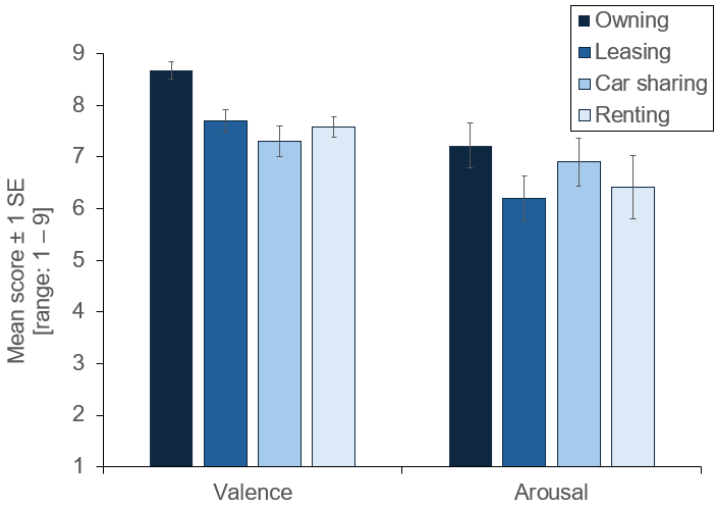
2.3 Results

2.3.1 Attachment to the car

Self-Assessment Manikin Scale. Figure 3 presents the results of the SAM for valence and arousal of the respective user group.

Figure 3

Mean values and standard errors (SE) for valence and arousal in the Self-Assessment Manikin Scale by user group



Concerning the question of emotional valence, all user groups scored in the upper range of the scale. This indicated that all participants had a positive attitude towards the car. The ANOVA revealed significant group differences ($F(3,32) = 6.79$, $p = .001$, partial $\eta^2 = .389$). Owners experienced more positive feelings towards their car than lessees (0.97, 95%-CI[0.09, 1.84], $p = .025$), car sharing users (1.37, 95%-CI[0.49, 2.24], $p = .001$), and renters (1.17, 95%-CI[0.21, 2.12], $p = .012$).

In terms of emotion intensity, all user groups scored in the mid-to-upper range of the scale, indicating that positive emotions were perceived as relatively strong. The ANOVA indicated no group differences regarding arousal ($F(3,31) = 0.98$, $p = .413$).

Product Emotion Measurement Instrument. Table 4 presents the number of mentions of each emotion and the percentage distribution within the user group.

Table 4

Number (n) and percentage distribution within each user group of the mentioned emotions of the Product Emotion Measurement Instrument (above: positive emotions, below: negative emotions)

Emotion	Owning		Leasing		Car Sharing		Renting		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Satisfaction	7	77.78	6	60	9	90	5	71.43	27	75
Amusement	7	77.78	4	40	2	20	5	71.43	18	50
Admiration	4	44.44	0	0.0	3	30	1	14.28	8	22.22
Pride	6	66.67	8	80	8	80	3	42.86	25	69.44
Desire	2	22.22	2	20	3	30	1	14.28	8	22.22
Fascination	1	11.11	1	10	0	0	1	14.28	3	8.33
Hope	1	11.11	1	10	1	10	0	0	3	8.33
Σ positive emotions	28		22		26		16		92	
Sadness	0	0	1	10	0	0	1	14.28	2	5.56
Fear	0	0	1	10	0	0	0	0	1	2.78
Boredom	0	0	0	0	1	10	0	0	1	2.78
Dissatisfaction	0	0	0	0	1	10	0	0	1	2.78
Shame	0	0	0	0	0	0	0	0	0	0
Contempt	0	0	0	0	0	0	0	0	0	0
Disgust	0	0	0	0	0	0	0	0	0	0
Σ negative emotions	0		2		2		1		5	

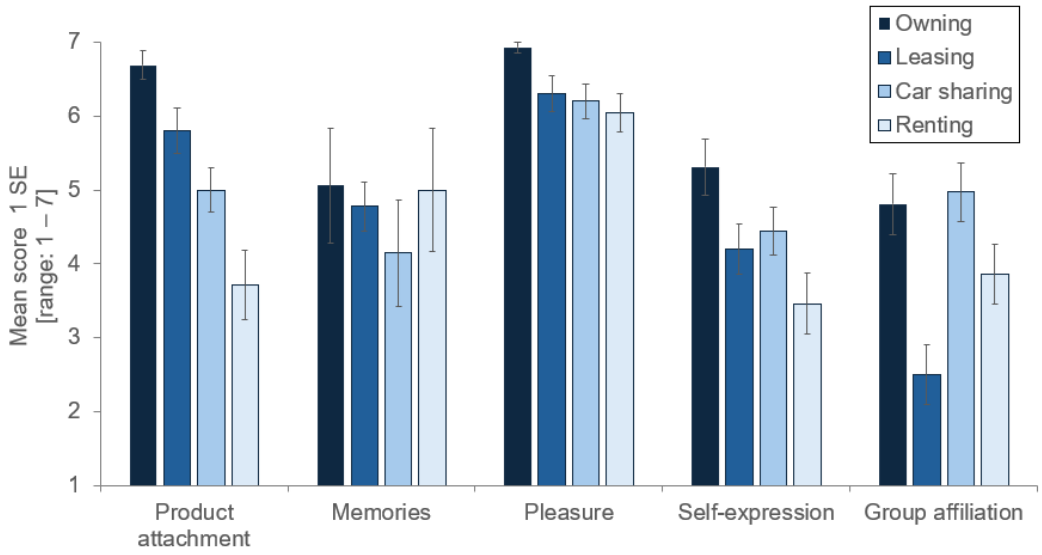
Note. Positive emotions are displayed at the top; negative emotions are displayed at the bottom. Multiple responses were possible.

A chi-square test was used to compare positive and negative emotions. Results showed positive emotions were felt more often than negative ones regarding the car ($\chi^2(1) = 78.03$, $p < .001$). The most chosen emotions were satisfaction ($n = 27$), amusement ($n = 18$), and pride ($n = 25$). Negative emotions played a minor role when participants thought about their car.

Product Attachment Scale. Figure 4 presents the means and standard errors of the respective PAS scales by user group.

Figure 4

Mean values and standard errors (SE) of the determinants of the Product Attachment Scale by user group



Product Attachment: Owners scored at the high end of the scale, with lessees and car sharing users also achieving values in the upper scale range. Renters, however, scored in the mid-range. The ANOVA revealed significant group differences ($F(3,32) = 14.16$, $p < .001$, partial $\eta^2 = .570$). Owners felt more attached to their cars than car sharing users (1.69, 95%-CI[0.51, 2.87], $p = .003$) and renters (2.98, 95%-CI[1.69, 4.27], $p < .001$). Additionally, lessees felt more attached to their cars than renters (2.09, 95%-CI[0.82, 3.35], $p = .001$), as did car sharing users compared to renters (1.29, 95%-CI[0.02, 2.55], $p = .045$).

Memories: Regarding memories, all groups scored in the mid-high range. A Welch's ANOVA was conducted as the assumption of equal variances was violated ($p = .020$). There was no evidence of group differences ($F(3,15.23) = 0.29$, $p = .830$).

Pleasure: All groups scored in the upper range of the scale regarding pleasure. The ANOVA revealed significant group differences ($F(3,32) = 3.14$, $p = .039$, partial $\eta^2 = .227$). Post-hoc comparisons revealed that this difference was driven by owners experiencing significantly greater pleasure than renters (0.88, 95%-CI[0.01, 1.75], $p = .048$).

Self-expression: Regarding self-expression, owners exhibited scores within the upper range of the scale, whereas lessees and car sharing users demonstrated scores in the mid-to-high range. Renters registered scores in the middle range. The ANOVA showed significant group differences ($F(3,32) = 4.07$, $p = .015$, partial $\eta^2 = .276$). Post-hoc comparisons revealed that this difference could be attributed to owners being able to express themselves more strongly through their cars than renters (1.85, 95%-CI[0.39, 3.32], $p = .009$).

Group affiliation: Owners and car sharing users scored in the mid-high range of the scale regarding group affiliation, while renters scored in the middle range and lessees scored in the lower range. The ANOVA revealed significant group differences ($F(3,32) = 8.64$, $p < .001$, partial $\eta^2 = .448$). Owners (2.31, 95%-CI[0.81, 3.82], $p = .001$) and car sharing users (2.47, 95%-CI[1.00, 3.93], $p < .001$) felt a stronger sense of group affiliation than lessees.

Inclusion of Other in the Self Scale. Owners scored highest in the IOS scale ($M = 5.78$, $SE = 0.36$), followed by lessees ($M = 4.5$, $SE = 0.40$), car sharing users ($M = 4.00$, $SE = 0.42$), and lastly, renters ($M = 3.86$, $SE = 0.40$). ANOVA revealed significant group differences ($F(3,32) = 4.54$, $p = .009$, partial $\eta^2 = .299$). Owners felt a significantly stronger connection to their cars than car sharing users (1.78, 95%-CI[0.27, 3.29], $p = .016$) and renters (1.92, 95%-CI[0.27, 3.57], $p = .018$).

Qualitative Data. Participants were asked to describe their emotions about the car using an open-ended approach. Table 5 summarizes the frequency of each emotion category and its relative distribution within each user group.

Table 5

Number of mentions (n) and percentage distribution within each user group by emotion

Emotion	Owning		Leasing		Car Sharing		Renting		Total	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Amusement	9	100	9	90	9	90	5	71.43	32	88.89
Satisfaction	8	88.89	7	70	9	90	4	57.14	28	77.78
Connectedness	9	100	9	90	9	90	0	0	27	75
Pride	9	100	7	70	5	50	2	28.57	23	63.89
Anticipation	1	11.11	2	20	4	40	5	71.43	12	33.33
Calmness	0	0	5	50	4	40	2	28.57	11	30.56
Well-being	4	44.44	2	20	0	0	3	42.86	9	25
Love	5	55.56	3	30	0	0	0	0	8	22.22
Happiness	2	22.22	3	30	0	0	1	14.29	6	16.67
Gratitude	2	22.22	1	10	0	0	0	0	3	8.33
Σ positive emotions	49		48		40		22		159	

Exclusively positive emotions were mentioned in the open-ended responses. Notably, amusement (*n* = 32), satisfaction (*n* = 28), connectedness (*n* = 27), and pride (*n* = 23) were frequently mentioned. Participants frequently associated amusement with driving pleasure. Satisfaction with the car was also highly prevalent across all groups. Interestingly, connectedness to the car was reported not only by owners and lessees but also by most car sharing users, while no renters felt a connection to the car.

Quotes from owners and lessees expressing pride often reflected a sense of accomplishment and a desire to showcase their achievement: "I am proud to have this car and to show it off, this is mine" (P1-7). Car sharing users also expressed pride, often mentioning the successful management of their car situation and being able to enjoy the freedom of a car without ownership: "I am proud to have managed to arrange trips and to have found a good solution for my car situation. I see 'my' Ford Focus from my window in the car sharing parking lot" (P3-8). Additionally, they felt more environmentally conscious: "I am proud that I am also making a social contribution.

Protecting the environment and sharing something with others is important to me" (P3-1).

Renters mentioned pride less frequently, more often expressing anticipation for the car and excitement to explore its features. Five owners reported loving their cars: "Sometimes I even love the car. I have so many photos of it on my phone, my wife is sometimes jealous" (P1-4). Lessees and car sharing users frequently mentioned a sense of calmness, often associating it with the car's reliability. Furthermore, car sharing users felt "freer and less tied down compared to owning a car, where I have to take care of everything" (P3-1).

Participants were also asked what makes their car special compared to others. Table 6 presents the number of mentions per characteristic and the percentage distribution within each user group assigned to the corresponding product quality of Hassenzahl (2005).

A chi-square test revealed a statistically significant prevalence of hedonic reasons for perceiving cars as special ($\chi^2(1) = 4.79$, $p = .029$). Specifically, owners ($\chi^2(1) = 4.92$, $p = .027$) and renters ($\chi^2(1) = 4.50$, $p = .034$) cited hedonic reasons more frequently than pragmatic ones (owners: $n = 34$ vs. $n = 18$; renters: $n = 22$ vs. $n = 10$). Lessees also tended to mention more hedonic characteristics ($n = 42$) than pragmatic ones ($n = 29$), although this difference did not reach statistical significance ($\chi^2(1) = 2.38$, $p = .123$). In contrast, car sharing users showed a non-significant trend towards valuing pragmatic reasons ($n = 34$) over hedonic ones ($n = 25$; $\chi^2(1) = 1.37$, $p = .241$).

Overall, the car's equipment ($n = 22$), associated memories ($n = 19$), and car size ($n = 19$) were the most frequently cited as reasons for its distinctiveness. The least frequently mentioned were the car's quality ($n = 4$), ease of use ($n = 6$), ownership ($n = 8$), and modernity ($n = 9$). However, ease of use was mentioned more often by car sharing users than by other groups. Ownership, naturally, was not a special feature for car sharing users or renters, yet nearly half of owners and lessees cited it as such. On the other hand, modernity was most frequently mentioned by renters, with over half citing it as a special feature.

Table 6

Number of mentions (n) and percentage distribution within each user group (%) of features by product quality and user group

Product quality	Emotion	Owning		Leasing		Car Sharing		Renting		Total	
		n	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
HQ	Memories	6	66.67	6	60	3	30	4	57.14	19	52.78
HQ	Appearance	6	66.67	6	50	2	20	3	42.86	17	44.44
HQ	Familiarity	2	22.22	5	50	6	60	3	42.86	16	44.44
HQ	Brand	3	33.33	5	50	2	20	2	28.57	12	33.33
HQ	Speed/ Performance	3	33.33	4	30	1	10	4	57.14	12	30.56
HQ	The FIRST (New/E-) Car	5	55.56	5	50	0	0	0	0	10	27.78
HQ	The car suits me	2	22.22	3	30	5	50	0	0	10	27.78
HQ	Driving experience	1	11.11	2	10	5	50	2	28.57	10	25
HQ	Modernity	2	22.22	2	10	1	10	4	57.14	9	22.22
HQ	Ownership	4	44.44	4	40	0	0	0	0	8	22.22
Σ HQ		34		42		25		22		123	
PQ	Car size	3	33.33	6	60	7	70	3	42.86	19	52.78
PQ	Safety	2	22.22	6	60	6	60	3	42.86	17	47.22
PQ	Reliability	4	44.44	4	40	5	50	0	0	13	36.11
PQ	Independence/ Flexibility	3	33.33	3	30	4	40	1	14.29	11	30.56
PQ	Economy	5	55.56	2	20	3	30	1	14.29	11	30.56
PQ	Practical	1	11.11	4	40	5	50	0	0	10	27.78
PQ	Ease of use	0	0	2	20	4	40	0	0	6	16.67
PQ	Quality	0	0	2	20	0	0	2	28.57	4	11.11
Σ PQ		18		29		34		10		91	
-	Equipment	6	66.67	9	90	3	30	4	57.14	22	61.11
-	Comfort	2	22.22	4	40	3	30	2	28.57	11	30.56

Note. PQ = Pragmatic quality, HQ = Hedonic quality, - = could not be clearly attributed

For owners, in addition to equipment (*n* = 6) and memories (*n* = 6), appearance (*n* = 6) was important. As one participant stated: "I have wonderful experiences with the car again and again, that is why I will never give it up" (P1-4). Moreover, five owners mentioned the car's economy, referring to its low purchase price and fuel consumption. The experience of owning a car for the first time was also significant, with participants mentioning it being their first car overall, their first electric car, or the first car they financed themselves: "I chose the car myself, even against resistance. Others tried to talk me out of it, but I did not let myself be swayed and decided for myself. It is my first own car" (P1-9). Owners rarely or never mentioned driving experience, ease of use, quality, or practicality.

Nine lessees cited the car's equipment as a distinguishing characteristic. One participant reported: "It had better gadgets. For example, a heated steering wheel. It is the first time I have had something like that, so I was really happy about it, even if it was just a small thing" (P2-7). Memories and car size also played a role for lessees. Additionally, more than half listed the car's safety as a special feature.

Among car sharing users, car size was also the most frequently cited special feature (*n* = 7). Unlike other user groups, they preferred smaller cars as they facilitated parking and were more practical in urban environments. One participant said, "I can fit into parking spaces that others can't" (P3-9). Familiarity and safety were also frequently mentioned. One participant emphasized that car sharing was not just about the car itself but also about the service and the fleet provider (P3-10).

Renters cited the fewest special features overall. In addition to equipment and memories, speed and modernity were special aspects of the car for them. One participant stated: "Because of the quality, the sporty driving style, and the performance, a connection develops during use" (P4-3).

Furthermore, owners and lessees reported the consequences of their emotional attachment to the car. We found that some owners (*n* = 5) and lessees (*n* = 3) anthropomorphized their cars. For example, they gave their cars names: "My acquaintances sometimes make fun of me when I talk about how my 'Fridolin' needs something again" (P2-9). Some compared their relationship to the car to a partnership, where "you look out for each other and are there for each other" (P2-9), or a friendship where you "go through thick and thin" (P1-3). They worried about "whether the car is

doing well, whether it is still alive" (P1-1), they did not want "the car to be scratched, you cherish and care for it" (P2-7). Therefore, they wanted to take care of the car: "I keep it clean; I clean and vacuum it often. I have it serviced regularly, change the oil before the recommended time, and do not immediately race when the engine is still cold" (P1-8).

In contrast, car sharing users and renters provided several reasons for not developing an attachment to car sharing vehicles or rental cars. One reason was that they did not own the car: "I do not feel any love because it is not my own car" (P4-8). When many different cars had already been rented, one participant reported a habituation effect, whereby the rental car no longer felt special. Furthermore, renters and car sharing users were aware of the limited use time: "It is always just a short-term relationship. You know it is not permanent. You know you must give it back" (P4-10). Additionally, it makes it difficult to build a relationship when renters cannot choose the car themselves. This is different for car sharing users: "I have the great advantage of being able to choose the i3: I look in the app to see if there is one there, sometimes even two hours before I want to book it. That always gives me a good feeling" (P3-7).

2.3.2 Attachment over time

UX curve. First, we examined the initial and final levels to determine how many attachment curves improved, deteriorated, or remained stable. The results are shown in Table 7.

Table 7

Number (n) and percentage distribution of improving, stable, and deteriorating UX curve trends by user group

	Owning		**Leasing**		**Car Sharing**		**Renting**	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Improving	7	77.78	6	60	9	90	4	57.14
Stable	2	22.22	1	10	0	0.0	1	14.28
Deteriorating	0	0.0	3	30	1	10	2	28.57

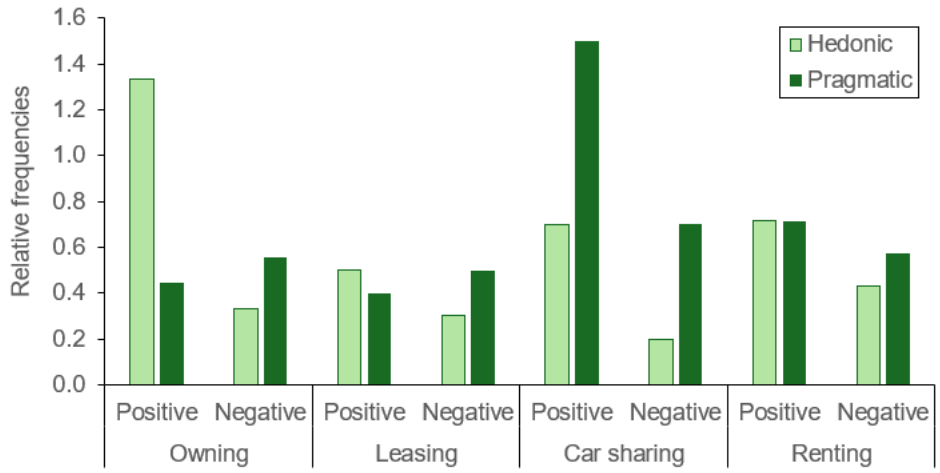
The relationship improved over time in most cases (n = 26). A chi-square test revealed a statistically significant increase in upward-trending curves over time ($\chi^2(2) = 24.67$, $p < .001$). This effect was particularly pronounced among car sharing users

($\chi^2(1) = 6.40$, $p = .011$). While owners also showed a tendency towards more increasing curves, this difference was not statistically significant ($\chi^2(1) = 2.78$, $p = .096$). Lessees and renters predominantly showed increasing curves; however, these results were not statistically significant (leasing: $\chi^2(2) = 3.80$, $p = .150$; renting: $\chi^2(2) = 2.00$, $p = .368$).

The reasons for the changes in the curve trend were coded according to Hassenzahl's (2005) model. Figure 5 illustrates the relative frequencies of the mentioned positive and negative, hedonic and pragmatic reasons sorted by user group.

Figure 5

Relative frequencies of positive and negative reasons for changes in the UX curve by user group

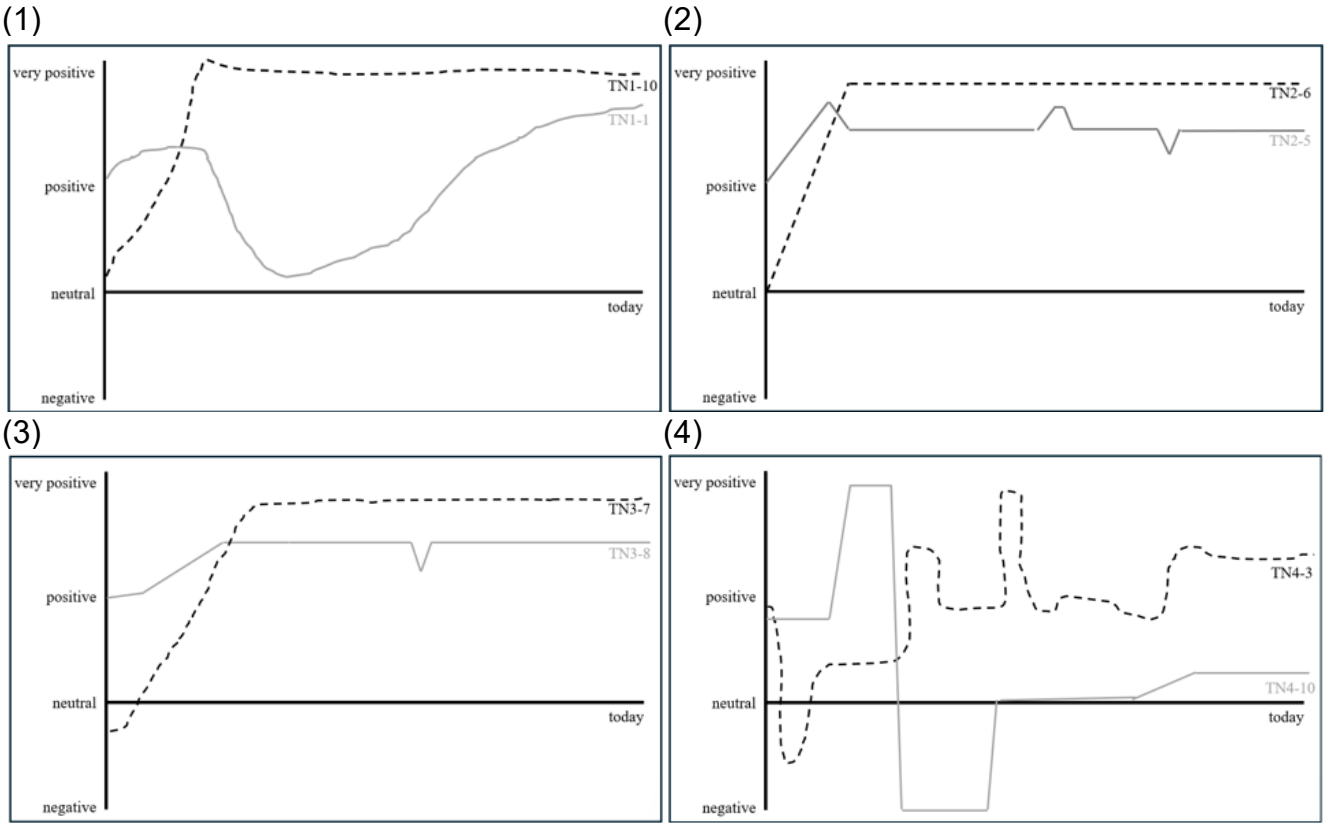


For owners, hedonic factors were associated with improving the relationship. However, this effect was just marginally significant ($\chi^2(1) = 3.20$, $p = .074$). Owners mentioned increasing identification ("Grown fond of it. It is mine." - P1-6) and evocation through shared experiences as contributing to the improvement. While the number of positive hedonic and pragmatic reasons was similar for lessees ($\chi^2(1) = 0.55$, $p = .457$) and renters ($\chi^2(1) = 0.08$, $p = .772$), the opposite pattern was observed for car sharing users. They tended to mention more pragmatic reasons for the upward curve; however, this difference was not statistically significant ($\chi^2(1) = 0.285$, $p = .593$). They mentioned the car's availability, cost, and size as reasons for improvement. As reasons for the decline of the relationship curve, all groups mentioned more pragmatic than hedonic reasons.

Figure 6 shows two exemplary UX curves of the participants for each user group: owners (1), lessees (2), car sharing users (3), and renters (4).

Figure 6

Exemplary UX Curves for an emotional relationship with the car for (1) owners, (2) lessees, (3) car sharing users, and (4) renters from the first contact with the car to today, from negative to very positive. The x-axis represents interindividual variations in time periods based on the duration of car usage by each participant



Exemplary UX curves revealed high similarity among owners, lessees, and car sharing users. Across these groups, the curves consistently exhibited an initial upward trend, followed by a plateau or a phase of marginal increase. Occasionally, dips in the curve were observed, but these were quickly corrected to previous levels. In contrast, the curves for renters displayed marked heterogeneity. Based on these observations, we identified three distinct use phases for owners, lessees, and car sharing users, during which changes in the emotional attachment to the car frequently occurred:

1. *Familiarization:* The familiarization phase was characterized by a substantial increase in the relationship between the users and the car. Owners and lessees reported feeling pleasure or even infatuation upon first contact with the car. They

reported feeling excited and proud. The car's driving experience, appearance, and ability to configure the car were cited as important reasons. However, one participant also reported sadness at giving up the old car, as some memories had been lost. Car sharing users, on the other hand, were initially more skeptical, as they had no prior experience with car sharing. The initial experience could also be overwhelming, such as when driving an automatic car for the first time. However, a few drives were sufficient to significantly increase the relationship positively, as participants reported feeling quickly safe and comfortable.

2. *Everyday Use:* After the initial infatuation phase, participants reported becoming accustomed to the car. This led to increased familiarity and connectedness. Owners and lessees reported having enjoyable experiences and trips with the car. The car had "grown on them" (P1-6), and they felt gratitude for the car. While one lessee reported looking forward to a new car after a certain time, another reported sadness about the upcoming return (P2-2). Car sharing users also reported primarily positive experiences during everyday use. They emphasized the car's availability, size, and driving pleasure.

3. *Malfunctions and Defects or Dirt:* Problems, such as malfunctions or accidents, could lead to a short-term decrease in the relationship. Typically, the relationship returned to its previous level after the car was repaired. Owners reported feeling disappointed, angry, and anxious during this phase. The uncertainty about the duration and cost of the repair was particularly prominent. For lessees, the fact that the car was no longer new was especially important. On the other hand, car sharing users had fewer concerns about defects, as they often did not have to participate. They reported temporary dips in the relationship when the car was dirty.

These use phases could not be clearly determined within the renters' group. They did not report experiencing a familiarization phase. Instead, the pick-up situation was seen as crucial. Long waiting times or a downgrade led to anger and frustration, while unexpected upgrades resulted in pleasure. Positive experiences, good weather, and a pleasant driving experience could bring joy during the rental period. Factors contributing to the decline in the relationship curve were bad weather, inferior quality compared to owning a car, and high costs.

Farewell. As most participants were still using their cars at the time of the study, the car farewell phase was discussed hypothetically. Participants were asked about their emotions regarding parting with their cars. These statements were categorized as positive, neutral, or negative. Table 8 presents the results of this categorization.

Table 8

Emotional ratings of farewell to the car by user group coded as positive, neutral, and negative

	Owning		Leasing		Car Sharing		Renting	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Positive	0	0.0	2	20	4	40	2	28.57
Neutral	1	11.11	0	0.0	0	0.0	5	71.42
Negative	8	88.88	8	80	6	60	0	0.0

Overall, negative feelings predominated (n = 22), confirmed by a chi-square test ($\chi^2(2) = 12.67$, $p = .002$). Owners reported that they initially wanted to keep the car and would part with it only if it was no longer roadworthy, had an accident, or incurred excessively high repair costs. Almost all owners (n = 8) experienced negative emotions when parting with the car, with a chi-square test confirming this as significant ($\chi^2(1) = 5.44$, $p = .020$). One participant described this potential loss, stating: "I would be devastated if someone crashed into me and the car was damaged. I would be so sad because it is my car, I have grown fond of it and have taken such good care of it over all these years. (...) There would be no equal replacement" (P1-10), highlighting the strong emotional connection. Owners also mentioned the potential loss of memories associated with the car. One reflected: "I associate the car with shared journeys. When I look in the rearview mirror, I see the child seat in front of me. When the Mercedes goes, the experiences become memories" (P1-1). They also expressed feelings of guilt, as if they were betraying and abandoning the car: "Maybe there would also be a feeling of betrayal because the car has accompanied me for so long and I owe it so much and then I am abandoning it" (P1-6). Furthermore, one participant compared parting with the car to "a family member who is leaving and will never return" (P1-3). Owners believed that time and a new car would help them overcome the negative feelings: "What helps? Time. You get over it. But it will always have a place in my heart.

If it ever comes to a separation, maybe also because of a new car - that helps too" (P1-6).

Conversely, lessees had fixed lease contracts with a specific expiration date, making parting with the car more foreseeable and requiring them to order a new car in advance. Like the owners, many lessees (n = 8) also reported negative feelings when parting with the car. This effect was marginally significant ($\chi^2(1) = 3.60$, $p = .058$). One participant said: "A separation would make me very sad and nostalgic. We were a team for so long. It was with me in the most important moments. I also do not like the idea that someone else gets it. That makes me sad. It is like heartbreak" (P2-2). Other lessees also reported negative feelings, which were somewhat less intense, e.g., "I would be sad then and would like to keep the car, but I am not going to cry now" (P2-6). Like the owners, they were sad about the memories that would be lost with the car. One lessee also compared parting with the car to losing a family member. In addition, one lessee reported the fear of a subsequent payment. However, two lessees felt positive emotions when parting with the car, as the anticipation of the next car outweighed the sadness: "Changing the car does not bother me. I am looking forward to the next one, if there is a car" (P2-8). The new car would help the lessees with the farewell: "The new car is brought, and the old car is taken away. It might take half an hour, then you are happy about the new car and can create your own little world again" (P2-6).

Car sharing users indicated that they would part with their car if it were no longer offered in the fleet or if they purchased their own car. Six car sharing users also reported negative feelings, although this effect was not significant ($\chi^2(1) = 0.40$, $p = .527$). Furthermore, these negative feelings were less intense than those of lessees and owners. One participant said: "That would be a pity, then I would try a different car, maybe an electric car" (P4-4). For four car sharing users, parting with the car would not be a big deal: "It is not a big farewell, it does not hurt" (P4-5). They suggested that a better successor model would help emotionally.

For renters, parting with the car came with its return. Renters did not experience negative feelings upon parting: „ I do not feel any emotions. I know I can always rent a new one" (P3-3). They mentioned that they would not mind parting with the car since they did not feel attached to it. Two renters reported positive feelings, as they were relieved that they had not caused any damage to the car and would not incur any

additional costs: "Relief when the car is returned to the station. (...) You no longer have any responsibility for the car" (P3-10).

Although most owners, lessees, and renters experienced negative emotions when parting with their cars, they differed in the intensity of the terms used. Table 9 shows the mentioned terms according to their intensity.

Table 9

Negative terms mentioned regarding the farewell to the car, according to their intensity, by user group

	Intensity of negative feeling				
	1- a pity	**2**	**3 - sad**	**4**	**5 - devastated**
Owning			sad (P1-1) sad (P1-2) sadness (P1-3) sad (P1-7)	it would hurt, sad, would cry (P1-6) it would hurt, sadness (P1-8) it would hurt, grieve, without perspective (P1-9)	devastated, very sad (P1-10)
Leasing	a pity (P2-9)		sadness (P2-2) doubts, sadness (P2-3) melancholy (P2-4) sad (P2-5) sad but no tears (P2-6) sad (P2-7)	sad, pain of separation (P2-1)	
Car sharing	a pity (P3-4) a pity (P3-7)	disap-pointment (P3-6) sad, a pity (P3-8)	sad (P3-1) sad, disappointed (P3-10)		

The vocabulary used to describe negative emotions varied across groups. Owners employed more intense terms, such as "devastated" (P1-10), while lessees used less

intense terms like "sad" (P2-6). Car sharing users exhibited the least intense negative emotions, frequently using the term "a pity" (P3-4).

2.4 Discussion

2.4.1 Discussion of main findings

This study investigated the emotional attachment between individuals and their cars. We focused on the factors influencing this attachment, the emotions involved, the role of car characteristics, the evolution of this attachment over time, and how different user groups vary in these aspects.

Our findings confirm previous research (Eckholdt, 2013; Hassenzahl, 2018; Puls, 2024; Steg, 2005), indicating that cars serve as more than just a means of transportation and primarily evoke positive emotions such as amusement, satisfaction, and pride. However, our results also reveal significant differences between user groups regarding the intensity and causes of their emotional attachments. Owners seem to have the strongest emotional attachment to their cars, followed by lessees, car sharing users, and renters. These differences are discussed below for each user group to understand the complex nature of human-car relationships better.

Owners develop a strong emotional attachment to their cars that goes beyond mere functionality. This attachment is shaped by long-term memories inextricably linked to the car. Consequently, parting with the car is challenging, as it involves losing not just the car but also a piece of personal history. Besides these emotional aspects, owners also appreciate their cars' aesthetic and functional qualities. They take pride in their possession and the status it represents, valuing an attractive appearance alongside extensive features, while also considering cost-effective use. Thus, owners encompass all dimensions identified by Hassenzahl (2005) that contribute to emotional attachments. This attachment strengthens over time as memories accumulate and identification with the car deepens, making even minor flaws more tolerable.

Lessees also develop an emotional attachment to their cars, albeit potentially less intense than that of owners. They particularly appreciate high-quality features that are both functionally and emotionally satisfying. The regular renewal of the leased car offers the opportunity to continuously use new models with improved features. Although lessees are not the legal owners, they perceive the car as "their" possession

and associate it with personal memories. In addition to features and design, factors such as car size and safety also contribute to emotional attachment. A notable difference from other user groups is the less pronounced sense of group affiliation. This suggests that brand or car class might be a more relevant reference group for lessees than simply their shared status as lessees. Nevertheless, all hedonic dimensions contribute to the emotional attachment of lessees.

Car sharing users also develop an emotional attachment to shared vehicles, which confirms the findings of Fraine et al. (2007). They experience similar emotions to owners and lessees, including amusement, satisfaction, and sometimes even pride. However, this pride is less about the specific car and more about the associated sustainable lifestyle and independence from car ownership. Furthermore, the sense of group attachment is stronger among car sharing users than in other groups, which could be due to their shared ecological and social orientation. Familiarity with the car also plays a role. Initially, car sharing users may feel neutral or slightly skeptical, but after a few interactions, this transforms into a positive relationship that remains relatively stable. This is particularly attributed to pragmatic aspects such as car size and ease of use in the city. Nevertheless, the attachment remains weaker than that of owners, as car sharing users are aware of the temporary nature of their use. Our findings partially confirm the results of Bardhi and Eckhardt (2012), who postulated a lower emotional attachment and lack of identification with temporarily used cars. However, our data suggest that the distinction between the car itself and the concept of car sharing is not always clear. The results on pride indicate that users link the two aspects.

Our findings for renters confirm the results of Bardhi and Eckhardt (2012). Renters, aware of the limited duration of their use, generally do not develop a long-term emotional attachment to the car. Although they often have positive experiences with the car during the rental period, especially during vacations, their relationship with the car remains superficial. They are pleased with upgrades at the time of booking and modern cars, but parting with the car is generally easy for them, as they can relinquish responsibility for the car.

Beyond the group differences, we identified four distinct use phases varying in emotional intensity: familiarization, everyday use, malfunctions and defects, and farewell.

In line with the findings of Kujala et al. (2011), we observed that the greatest change in emotional attachment occurs during the first use phase. This phase is primarily characterized by the novelty of the car, which aligns with the findings of Hassenzahl (2005). As users become more accustomed to the car over time, the attachment does not increase as strongly as initially (Hassenzahl, 2006). However, the emotional attachment remains at a high level or even increases slightly, which can be attributed to the accumulation of memories and identification with the car (Hassenzahl, 2006; Mugge et al., 2005; Norman, 2005). Negative emotions arise when the car's functionality is impaired due to malfunctions or defects, and the emotional attachment temporarily decreases. Once the car is repaired, the emotional attachment returns to its previous level. This suggests pragmatic product qualities can be considered hygiene factors that must be fulfilled for an emotional attachment to develop (Diefenbach, 2012). Furthermore, we demonstrated that the farewell to a car primarily evokes sadness in users, as memories associated with the car are lost. At the same time, users may also experience anticipation and excitement about the new car.

Our findings provide new insights into users' emotional attachment to cars, highlighting the importance of product qualities and memories in developing this attachment.

2.4.2 Practical implications

This research offers valuable insights for the automotive industry, impacting areas from marketing to product development.

- Marketing and Sales: Marketing must address target groups' rational and emotional needs. While car sharing users prioritize social, ecological, and practical benefits, rental customers are drawn to modern technologies and performance features. For private purchases and leases, marketing should highlight shared experiences and personalization options, like custom interior finishes.
- Product Development: Integrate the entire user experience into product development, from initial interaction to final farewell. This includes both physical interaction with the car and digital integration. Individualizing the car through personalized elements, such as custom-stitched leather steering wheels and acoustic enhancements, like premium sound systems, can strengthen brand

identification. Developers should also create opportunities to link and preserve memories associated with the car, even after it is returned, perhaps through digital memory books or personalized farewell messages.

- Customer Service: Proactive customer service is essential. During car changes, enhance anticipation for the new model to mitigate negative emotions associated with parting from the old one. This can be achieved through regular status updates, personalized configuration options, and close customer contact. For technical issues, a quick and uncomplicated resolution is crucial to maintain the car's operation.
- User Onboarding: Car sharing providers must offer a simple and intuitive introduction to car functions to avoid overwhelming users. A digital tutor could effectively achieve this by explaining key features before or during use.

In addition to these practical implications, the findings also have limitations and suggest directions for future research, discussed below.

2.4.3 Limitations and future work

While this study provides valuable insights into emotional attachment to cars, several limitations offer opportunities for future research to expand upon these findings.

One limitation is the small sample size. Each of the four groups had a maximum of ten participants, which may have restricted our ability to detect statistically significant effects. Although this study included participants from various regions of the country, only individuals from Germany were considered, which limits the generalizability of the results. Additionally, we recruited participants with an emotional attachment to the car. While this was essential for examining the development of this attachment over time within individuals, it also restricts the generalizability of the results.

Future studies should employ larger, more diverse samples, including participants from different countries and with varying degrees of emotional attachment to their cars. Including individuals with lower attachment could reveal important differences in how relationships with cars develop and evolve.

Methodologically, future research could complement self-report measures with physiological data, such as heart rate variability or skin conductance, to provide a more

comprehensive understanding of emotional responses to driving experiences (Tiberio et al., 2013).

The retrospective nature of the UX Curve analysis, particularly the lack of standardized temporal units on the X-axis, presents another limitation. The differing timeframes considered for owners (years) and renters (weeks) make direct comparison challenging and may obscure important nuances in the development of attachment. Furthermore, the UX Curve only captures attachment up to the study date, not across the entire lifecycle of car ownership or use. While retrospective methods provide a valuable overview, prospective longitudinal studies would allow researchers to track the development of attachment in real-time, examine the influence of external factors, and verify the stability of these findings over time.

Despite these limitations, this study significantly advances our understanding of emotional attachment to cars across different user groups, particularly by highlighting the dynamic nature of these relationships. This research provides a foundation for future investigations into the complex interplay of emotional, social, and practical factors that shape human-car attachments, offering valuable insights for the automotive industry.

3. Understanding Emotional Attachments to Cars: Insights from Multiple Online Surveys

Author	Author position	Scientific ideas %	Data generation %	Analysis & interpretation %	Paper writing %
Mareike Grund	1	90	100*	90	90
Ingo Totzke	2	10	0	5	5
Arnd Engeln	3	0	0	5	5
Title of paper:		Understanding Emotional Attachments to Cars: Insights from Multiple Online Surveys			
Status in publication process:		submitted			

* A UX team from Audi AG (Audi Innovator Circle) programmed the online questionnaires and recruited participants for the first preliminary study, a UX team from CARIAD SE for the second preliminary study, and Spiegel Institut Ingolstadt GmbH for the main study.

Abstract

According to previous qualitative studies, users form emotional attachments to cars, varying among different user groups. Two preliminary studies (N = 410; N = 487) and one main study (N = 600) were conducted as online surveys for quantitative evaluation. The determinants of emotional product attachment, reasons for and against it, and the influence of car usage duration among different user groups (owners, lessees, and car sharing users) and car classes (premium vs. volume cars) were examined. Results show differences in attachment across both user groups and car classes. Owners show the highest attachment, followed by lessees and, at least, car sharing users. Premium car users show higher attachment values than volume car users, which is less pronounced among car sharing users. By quantitatively examining and expanding upon previous qualitative research, this study introduces car class as a novel variable in the context of emotional attachment to cars. These findings provide valuable insights for the automotive industry, enabling the development of targeted marketing strategies that cater to the distinct emotional needs of various customer segments. Furthermore, this research enhances the understanding of emotional product attachment theoretically and offers practical implications for improving customer satisfaction and loyalty in the automotive sector.

3.1 Introduction

Users can form emotional attachments to objects. An emotional product attachment is defined as the “strength of the emotional bond a consumer experiences with a durable product” (Schifferstein & Zwartkruis-Pelgrim, 2008). Emotional attachments have always been a unique selling point because they impact user behavior, such as brand loyalty, user experience, and willingness to invest (Bengler, 2017).

For many users, the car is more than just a means of transportation (Cullinane, 1992; Steg, 2005). Attachment to the car can be influenced by various factors, such as the duration of use, memories and experiences associated with it, or the opportunity to express oneself or feel part of a group (Mugge et al., 2008). Modern technologies and features create new opportunities for interaction and reshape how users perceive, use their cars, and what they expect from them (Bengler, 2017; Pettersson & Ju, 2017). For instance, the choice of car type is influenced by the anticipated driving experience, which includes different possible driving styles. This leads to an increasing diversification of the car market with premium and volume cars. Premium cars are often associated with higher social status and greater convenience (Vigneron & Johnson, 1999), while volume cars are designed to be affordable (Kapferer & Bastien, 2009). Additionally, new mobility concepts such as car sharing and leasing have gained importance (Shaheen & Cohen, 2012). While owners typically keep their cars for a long time and can personalize them according to their preferences, lessees and car sharing users may maintain a less strong emotional attachment due to the more temporary and impersonal nature of their car usage (Bardhi & Eckhardt, 2012). This raises the question of how emotional attachment develops over time among the different user groups, especially considering the rapid introduction of new car features to the market, which can make one’s own car seem outdated more quickly. However, emotional attachment to the car has not yet been thoroughly investigated.

This article makes three main contributions to a better understanding of the emotional attachment between users and their cars. Previous research has primarily explored emotional attachment to cars using qualitative data from interviews with small samples (Grund et al., 2025b). This article quantitatively reviews and supplements these findings with larger samples. Firstly, our analysis systematically explores various determinants of product attachment and identifies factors fostering or hindering emotional attachments to cars. The results confirm previous qualitative findings,

indicating car owners experience stronger emotional attachments than lessees or car sharing users, although both groups do exhibit some level of emotional attachment as well. Secondly, we introduce car class as a novel variable and investigate how emotional attachment to cars varies across different car classes (premium vs. volume cars). The findings reveal that premium car users experience a stronger emotional attachment than volume car users. Interestingly, this difference is less pronounced among car sharing users than owners and lessees. Thirdly, we examine the temporal dynamics of emotional attachment using cross-sectional, interindividual data, thereby contributing methodologically by comparing our results to retrospective, intraindividual data from prior research. We derive recommendations for studying the temporal development of emotional attachments, which are also helpful for other contexts in consumer research.

This article contributes to a deeper understanding of emotional attachment and users' emotional needs. This enables marketers to develop targeted strategies that address emotions and inform the design and functionality of cars, promoting emotional attachment and user satisfaction.

3.2 Theoretical background

3.2.1 Emotional product attachment

Individuals often form strong emotional attachments not only to other people but also to brands and products (Page, 2014; Park et al., 2010). These emotional attachments influence purchasing decisions, brand loyalty, and long-term overall satisfaction with products (Diefenbach & Hassenzahl, 2017; Muniz & O'Guinn, 2001).

Hassenzahl (2005) proposed categorizing experienced product qualities into two primary types: hedonic and pragmatic. Pragmatic qualities, such as usability and utility, contribute to immediate task completion. Hedonic qualities focus on the emotional experiences. The more a product aligns with the hedonic dimension, the stronger the emotional attachment (Winder, 2006). Hedonic qualities encompass three dimensions: (1) *Stimulation* refers to the product's ability to motivate through novelty, excitement, and curiosity (Hassenzahl, 2005). (2) *Evocation* describes the product's capability to evoke personal memories and feelings (Hassenzahl, 2005). (3) *Identification* involves the user's tendency to attach personal value to the product and express themselves through it (Hassenzahl, 2005).

Mugge (2007) focused on emotional product attachment and identified four influencing factors that partially align with Hassenzahl (2005). These factors include (1) Pleasure, which describes the immediate enjoyment and positive mood experienced during product interaction (Mugge, 2007). Although not explicitly included in Hassenzahl's model (2005), this can be viewed as part of stimulation. (2) Memories refer to the positive emotions and memories evoked through the product (Mugge, 2007), paralleling Hassenzahl's dimension of evocation (Hassenzahl, 2005). (3) Self-expression describes the user's desire to differentiate themselves from others and express their identity through the product (Mugge, 2007), partly corresponding to Hassenzahl's concept of identification (Hassenzahl, 2005). (4) Group affiliation refers to the user's need to feel integral to a social group and gain external recognition and acceptance through the product (Mugge, 2007), which has no direct equivalent in Hassenzahl's model (2005) but could be considered an extension of the concept of identification.

Previous studies have also identified these factors as relevant for establishing an emotional attachment (Belk, 1988; Muniz & O'Guinn, 2001; Richins, 1994; Schouten, 1991).

3.2.2 Factors influencing emotional product attachment

An important factor for emotional attachment to a product is the ownership status. Possessions can be considered as part of the self and often contribute to self-confidence (Belk, 2010; Hassenzahl, 2004). Additionally, they serve as a means of external communication (Mugge, 2007; Richins, 1994). In contrast, sharing focuses more on the idea of sharing than the product itself, as motives such as utility or economy, social justice, or environmental protection take priority (Belk, 2010).

Product characteristics themselves, such as the difference between premium and volume products, can also influence emotional attachment. Premium products are significantly above the average price in a market and are typically associated with high quality, exclusivity, and high customer satisfaction. Accordingly, emotional product attachment is primarily shaped by the perceived value and uniqueness of the product (Kapferer & Bastien, 2009; Kotler et al., 2017). Users' attachment is influenced by the expression of users' identity through certain products or brands and the associated increase in social status (Belk, 1988; Vigneron & Johnson, 1999). This may result in

users experiencing a sense of belonging to a distinct group (Kotler et al., 2017; Muniz & O'Guinn, 2001). Volume products are distinguished by a lower price and/or a higher quantity, which makes them more accessible to a larger number of users. Such products are typically more utilitarian in nature and are often perceived as more interchangeable, leading to a comparatively weaker emotional attachment (Lantos, 2007). This is consistent with Park et al. (2006), who stated individuals utilizing a premium product tend to exhibit a stronger emotional brand attachment due to their capacity to extend their self-concept through ownership, compared to those engaging with a volume product. However, recent studies indicate volume products can also elicit emotional responses, particularly when they satisfy specific psychological needs. For example, nostalgia or habit can foster an emotional attachment to a specific volume product (Hassenzahl et al., 2010).

Time is another crucial factor influencing emotional product attachment, as value perceptions can change over time. While pragmatic qualities remain more or less stable, the perception of hedonic qualities is dynamic (Wilamowitz-Moellendorff et al., 2007). This is caused by adding or omitting determinants (Mugge et al., 2005): the product may lose attractiveness as its novelty decreases (Hassenzahl, 2006). However, as the number of product-related memories and identification with the product increase over time, the product may gain attractiveness (Karapanos, 2013). Additionally, the product becomes more familiar to users (Hassenzahl, 2006) and frequent interactions, positive associations, and memories foster long-term positive emotions towards a product (Norman, 2005). A positive correlation exists between positive memories and the level of product attachment, which can lead to increased product loyalty over time (Mugge et al., 2005). Significant changes in product attractiveness occur early in usage (Kujala et al., 2011), which aligns with (Pettersson, 2016), who emphasized the importance of initial impressions for long-term loyalty. Nonetheless, perceptions of attractiveness can vary over time across different product categories (Wilamowitz-Moellendorff et al., 2007).

3.3.3 Application to the automotive context

A car offers potential for emotional attachment (Sheller, 2004; Steg, 2005). It enables participation in activities, facilitating social integration through weekend trips, commuting to the office, or visiting friends (Kent, 2014; Stanley et al., 2011). Furthermore, it provides convenience with features such as speed, flexibility, and

safety (Kent, 2014; Steg, 2005). The car is not merely a means of transport; it serves pragmatic purposes as well as affective and symbolic functions, tying into deeper needs and emotions (Steg, 2005). Due to its speed and the discovery of new functions, the car can act as a source of stimulation (Gkouskos et al., 2015). Simultaneously, memories of shared experiences are formed while using the car (Grund et al., 2025b; Steg, 2005). Additionally, users can express and define themselves within their social environment by selecting their car and further personalization options. For instance, choosing a premium car can convey success, freedom, and social status, thus influencing self-perception, as the car is recognized as an extension of the self (Belk, 1988). A premium car is defined as a vehicle from a brand that can command a price markup of at least 20% compared to volume manufacturers (Dudenhöffer, 2014). According to this definition, brands such as Audi and Mercedes are classified as premium cars, while VW and Skoda, for instance, are categorized as volume cars. A premium car can enhance the sense of group affiliation by serving as an external cue that integrates the user into a community of successful and entrepreneurial individuals (Holmqvist, 2015).

The relationship with the car was qualitatively investigated among owners and drivers of work vehicles, such as taxi drivers (Fraine et al., 2007). The findings indicate the car is frequently perceived as a primary territory, even without ownership. It serves as a protective space from the external environment, is linked to personal memories, and is often subject to personalization. Different user groups, including owners, lessees, car sharing users, and renters, were also examined (Grund et al., 2025b). All participants in this study reported feeling emotionally attached to their car. Furthermore, the car sharing users in this study consistently used the same car over long time periods. The findings revealed that emotional attachment is highest among owners, followed by lessees, car sharing users, and lastly, renters. Thus, it is assumed that renters have no relevant emotional attachment to their rental cars (Grund et al., 2025b). Although all user groups experience pleasure from the car, it seems generally strongest among owners. Owners also express themselves through the car more than renters. Group affiliation is particularly strong among owners and car sharing users, whereas the groups do not differ in terms of memories associated with the car. Owners and lessees particularly value the equipment and appearance of their car and the associated memories, while car sharing users emphasize the right size, practicality,

and safety (Grund et al., 2025b). These findings align with previous research (Bardhi & Eckhardt, 2012), where car sharing users, unlike car owners, do not develop a sense of ownership or identification with the car. Instead, they prioritize its utility. Furthermore, car sharing users see their relationship with the car as more utilitarian and less emotional, even if they want to communicate a sustainable and social lifestyle through the car (Schaefers, 2013).

The user groups also differ in terms of the duration of their use. While owners use the car for a long time (Instamotion, n.d.), a typical leasing contract in Germany lasts only two to four years (Leschau & Baumgarten, 2024), and car sharing users use the car only for specific purposes. It is not permanently available to them. It is suggested that temporary use hinders the development of strong attachment (Bardhi & Eckhardt, 2012). Nevertheless, the attachment curve to a car becomes more positive over time for all user groups (Grund et al., 2025b). The emotional relationship of owners and lessees is positive from the start, as pleasant anticipation outweighs some uncertainty about the new car. Car sharing users are initially neutral, as they have no previous experience with the concept. With increased use, trust and emotional attachment to cars grow as users become more familiar with the car and its functions. In case of malfunctions or defects, the curve may temporarily dip as functionality is impaired and the novelty value of the car decreases (Grund et al., 2025b; Hassenzahl et al., 2015). It is important to mention that these findings are based on users who all reported having an emotional attachment to their car.

3.3 The current research

Previous studies on emotional attachment to cars relied on qualitative data with relatively small sample sizes. Therefore, validating these findings using a larger and more heterogeneous sample in a quantitative study is essential. Building on prior research, we propose that the emotional attachment to cars differs between user groups, specifically owners, lessees, and car sharing users. We hypothesize that owners exhibit the strongest emotional attachment to their cars, as they tend to keep their cars for longer periods, accumulating more memories and experiences. Given that possessions can be seen as an extension of the self, we expect that self-expression is highest among car owners. In contrast, car sharing users, who lack an ownership orientation and primarily use cars for practical purposes, are expected to exhibit the weakest emotional attachment.

Furthermore, we investigate how emotional attachment varies across car classes for the first time. Based on previous studies showing that premium products are more likely to be used for external self-expression and group affiliation, we predict emotional attachment to be stronger for premium cars than for volume cars. This is particularly relevant in the context of cars, which are often employed as status symbols due to their inherent expense.

We systematically examine the factors contributing to or hindering emotional attachment to cars, drawing on prior research. We expect owners most frequently cite hedonic reasons, while pragmatic reasons are more prevalent among car sharing users, and lessees are somewhere in between. Conversely, we hypothesize that the absence of hedonic factors hinders an emotional attachment. This is grounded in hedonic values, which are crucial for forming emotional attachments transcending pragmatic considerations.

Prior research has only examined the development of emotional attachment over time using intraindividual data from participants who all demonstrated emotional attachment to cars. We validate these findings using cross-sectional interindividual data from a larger and more diverse sample, expecting similar patterns.

To test these predictions, we conducted two preliminary studies and one main study as online surveys, to gather quantitative insights into the emotional human-car attachment and identify statistically significant effects. For the two preliminary studies, we leveraged the participant pools from other research groups within the corporation to facilitate recruitment, which enabled us to rapidly acquire preliminary insights, refine our research questions, and pilot-test our methods. However, the first preliminary study is limited by its sample characteristics, and the second preliminary study is constrained by the number of questions we could pose. To address these limitations, we conduct the third study, which is designed to overcome the methodological constraints of the two preliminary studies. The main study design involves analyzing different user groups (owners, lessees, and car sharing users) of premium and volume cars about their determinants of product attachment, the factors facilitating or hindering emotional attachment, and the influences of usage duration. All surveys are administered and completed in German language.

Given that our study utilizes existing user groups and their corresponding car classes as independent factors, we are constrained to a naturalistic study design, which precluded randomization. Building on this design, we employ a consistent set of measurement tools across all studies, which will be described in detail in the following section.

3.4 Methods

3.4.1 Measurements

Inclusion of the Other in the Self (IOS) scale. The single-item IOS scale by Aron et al. (1992) measures how close participants feel to another person, group, or object. The scale consists of seven pairs of circles overlapping to varying degrees, ranging from two separate circles that only touch (1) to two circles that almost completely overlap (7). One circle was labeled 'Self' and the other 'Car'. The participants had to choose the option that best expressed their attachment to their car. The IOS scale was used in all studies.

Product Attachment Scale (PAS). The PAS by Mugge et al. (2005) measures product attachment through the determinants of memories, pleasure, self-expression, and group affiliation. Participants rated their agreement on a seven-point Likert scale, ranging from 'strongly disagree' (1) to 'strongly agree' (7). The scale was translated into German and adapted for the automotive context. The items were presented randomly to the participants. The items are listed in Table 10 (in English), along with Cronbach’s alpha for each determinant. The internal consistency was high to excellent across all scales in each study. The PAS was utilized in all three studies, except for the group affiliation subscale, which was excluded in preliminary study 2.

Table 10

Items of the PAS and Cronbach's α for each study

Determinant	Cronbach's α			Item
	Pre-study 1	Pre-study 2	Main study 3	
Product attachment	.89	.89	.86	I am very attached to my car My car has no special meaning to me (-) My car is very dear to me I have a bond with this car
Memories	.94	.94	.90	My car reminds me of people or events that are important to me My car makes me think back of someone or something that has happened I see my car as a reminder of certain people or events Through my car I think back to certain people or events
Pleasure	.82	.85	.83	I enjoy my car It is a pleasure to use my car I feel good when I use my car
Self-expression	.75	.82	.76	My car reflects who I am Other people can tell by my car what kind of person I am My car fits my identity My car suits me My car says nothing about me as an individual (-)
Group affiliation	.75		.75	My car indicates that I am a car owner/ lessee/ car sharing user* Through my car I feel connected to other car owners/ lessee/ car sharing user* Through my car I belong to the group of car owners/ lessee/ car sharing user*

Note. (-) Indicates a reversed item. *was adapted according to the user group the participant belonged to.

Reasons for emotional attachment. The item "How strong would you rate your emotional attachment to this car?" was used to capture the participants' self-assessment of their attachment. Responses were collected on a six-point scale from 'very weak' (1) to 'very strong' (6). Their correlation with the 'product attachment' determinant of the PAS (preliminary study 1: $r = .610$, $p < .001$; main study 3: $r = .729$, $p < .001$) and the IOS scale (preliminary study 1: $r = .644$, $p < .001$; main study 3: $r =$

.693, $p < .001$) can be classified as high (Cohen, 1988). Participants who responded between 1 and 3 were then presented with possible reasons for low emotional attachment to the car. In contrast, participants who responded between 4 and 6 were presented with possible reasons for having a high emotional attachment to the car. These reasons presented were based on qualitative findings of previous research (Grund et al., 2025b). In preliminary study 1, participants could select as many reasons as they liked, while in the main study 3, they could select up to three reasons. Additionally, there was an option to provide additional reasons in an open-ended field. This was used in preliminary study 1 and the main study 3.

Product Emotion Measurement Instrument (PrEmo2). The PrEmo2 by Laurans and Desmet (2017) captures emotions related to product use through cartoon animations. It presents seven positive emotions (desire, amusement, admiration, satisfaction, fascination, pride, hope) and seven negative emotions (contempt, disgust, dissatisfaction, boredom, shame, fear, sadness). Participants were asked about their emotions regarding their car. Multiple choices were allowed. The PrEmo2 was only used in preliminary study 1.

3.4.2 Analysis

The data were analyzed using Microsoft Excel 2016 and IBM SPSS Statistics 27. Descriptive statistics were calculated, and data were screened for plausibility. For inferential statistical analysis, a multivariate analysis of variance (MANOVA) was conducted for the PAS, along with post-hoc univariate analyses of variance (ANOVA) for each determinant. Wilk's Λ was chosen as the multivariate test statistic. An ANOVA was also performed for the IOS scale. The dependent variables were the determinants of the PAS and IOS, respectively, with the independent variables 'user group' (in all studies) and 'car class' (in preliminary study 2 and main study 3). Assumptions were checked. Post-hoc Tukey-Kramer tests were used to identify specific group differences. When a significant effect was found, separate *t*-tests with Bonferroni-Holm correction were conducted for each user group with the independent variable 'car class'. Welch's *t*-tests were employed when needed.

The relationship between 'Product attachment' and 'Duration' was visualized using a scatterplot. A locally weighted scatterplot smoothing (LOESS) regression with an Epanechnikov kernel, and a 50% span was applied to capture the non-linear trends in

the data. To ensure the robustness of the findings, extreme outliers were eliminated using a 3-interquartile range (IQR) criterion. Furthermore, we examined the bivariate correlations between the determinants of 'Product attachment' and 'Duration'.

The PrEmo2 and the reasons for and against emotional attachment were analyzed using both absolute and relative frequencies. The reasons were categorized into hedonic and pragmatic factors.

3.5 Preliminary study 1

3.5.1 Study design and sample

The preliminary study 1 was conducted in July 2022 in Germany with a company-internal participant pool. Therefore, the sample consisted exclusively of users of cars from one premium brand, which severely limits the generalizability of the findings. Participants were contacted via email and invited to answer an online questionnaire. An ethics review revealed no concerns. Initially, the variable 'user group' was defined in three categories: owners, lessees, and car sharing users. To be classified as a car sharing user, individuals must use car sharing services at least once a month. However, due to the small number of car sharing users (n = 4), in preliminary study 1 this group was excluded from the data analysis. The final sample included N = 410 participants, consisting of n = 242 owners and n = 168 lessees (n = 362 males, n = 48 females). Age was collected in categories and is presented in Table 11.

Table 11

Number (n) of participants by age in categories in years (preliminary study 1)

	Age categories					
	18 – 29	**30 – 39**	**40 – 49**	**50 – 59**	**60 – 69**	**> 70**
Owning	9	17	54	98	53	11
Leasing	3	12	49	64	32	8

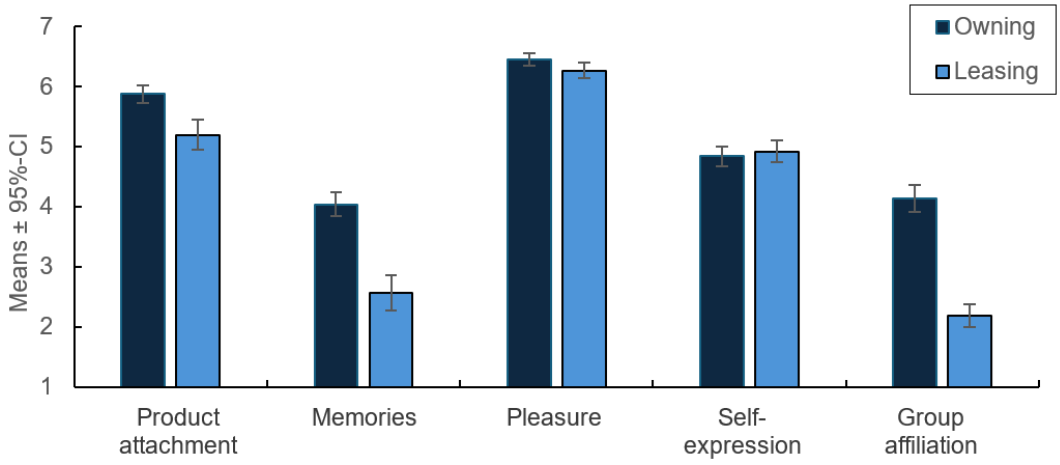
Participants first completed questions to assign them to the user groups. They were then asked to complete the PAS, the IOS scale, and the PrEmo2. Subsequently, they rated their self-perceived emotional attachment to their car and selected any number of reasons from a predefined list to explain why they felt more or less emotionally attached to their car.

3.5.2 Results

The mean values of the PAS for owners and lessees are presented in Figure 7.

Figure 7

Mean values for the determinants of the PAS by user group (preliminary study 1)



Note. Mean values for Product attachment and the determinants memories, pleasure, and self-expression according to the user groups owning and leasing. Error bars show 95%-confidence intervals.

The descriptive analysis revealed scores in the upper range of the scale for both groups regarding product attachment and pleasure. For self-expression, both groups scored somewhat lower, but remained in the upper range of the scale. However, there are larger differences in memories and group affiliation, with owners scoring in the medium range of the scale and lessees scoring in the lower range.

A one-way MANOVA with the independent variable 'user group' (owners vs. lessees) indicated significant differences (Wilk's $\Lambda = .614$, $F(5, 387) = 48.723$, $p < .001$, partial $\eta^2 = .386$). Follow-up ANOVAs (see Table 12) revealed owners had a stronger emotional attachment to their car compared to lessees ($F(1, 391) = 24.15$, $p < .001$, partial $\eta^2 = .058$), which was reflected in stronger associated memories ($F(1, 391) = 70.91$, $p < .001$, partial $\eta^2 = .154$), a higher sense of group affiliation ($F(1, 391) = 145.80$, $p < .001$, partial $\eta^2 = .272$), and greater pleasure ($F(1, 391) = 4.42$, $p = .036$, partial $\eta^2 = .011$). The effects for product attachment, memories, and group affiliation were large ($\eta^2 \geq .058$). However, there were no differences in self-expression ($F(1, 391) = 0.36$, $p = .551$).

Table 12

Test of between-subjects effects (preliminary study 1)

	Dependent variable	*df*	*F*	*p*	partial η²
User group	Product attachment	1	24.15	< .001*	.058
	Memories	1	70.91	<.001*	.154
	Pleasure	1	4.42	.036*	.011
	Self-expression	1	0.36	.551	.000
	Group affiliation	1	145.80	< .001*	.272
Error	Product attachment, Memories, Pleasure, Self-expression, Group affiliation	391			

Note. $*p < .05$

Additionally, owners (M = 5.13, SD = 1.28) expressed a higher attachment to their car through the IOS scale than lessees (M = 4.45, SD = 1.66). A Welch's t-test confirmed this difference to be significant ($t(298.25) = 4.490$, $p < .001$).

According to the PrEmo2 both owners and lessees predominantly associated positive emotions with their car. In particular, satisfaction, amusement, and pride were frequently mentioned. Both groups rarely reported negative emotions. Table 13 shows the absolute frequency and relative proportion of the mentioned emotions for the entire user group.

Table 13

Number (n) and percentage (%) of participants mentioning emotions in the PrEmo2, categorized by user group

Positive emotions	Owning		Leasing		Negative emotions	Owning		Leasing	
	n	%	*n*	%		*n*	%	*n*	%
satisfaction	134	55.4	102	60.7	dissatisfaction	6	2.5	10	6.0
amusement	113	46.7	75	44.6	sadness	3	1.2	1	0.6
pride	103	42.6	69	41.1	boredom	1	0.4	2	1.2
admiration	44	18.2	33	19.6	contempt	1	0.4	0	0.0
desire	34	14	21	12.5	shame	1	0.4	0	0.0
fascination	25	10.3	27	16.1	disgust	1	0.4	0	0.0
hope	18	7.4	13	7.7	fear	0	0	0	0.0

In the self-assessment, *n* = 185 owners and *n* = 107 lessees reported having an emotional attachment to their car. Table 14 presents the reasons for an emotional attachment for owners and lessees.

Table 14

Number (n) and percentage (%) of participants mentioning reasons for an emotional attachment, categorized by user group (preliminary study 1)

Product Quality	Reason	Owner		Leasing	
		n	**%**	***n***	**%**
HQ	It looks beautiful	160	86.49	107	100.00
HQ	The driving experience	149	80.54	102	95.33
-	It has great features	131	70.81	99	92.52
HQ	I like the brand	126	68.11	73	68.22
PQ	It is safe	117	63.24	103	96.26
HQ	It suits me	112	60.54	86	80.37
PQ	It works reliably	109	58.92	75	70.09
HQ	It is mine	107	57.84	13	12.15
-	It is comfortable	106	57.30	93	86.92
HQ	It is fast/powerful	95	51.35	57	53.27
HQ	It is modern	77	41.62	84	78.50
PQ	It makes me independent	77	41.62	52	48.60
PQ	It has a good size	76	41.08	59	55.14
-	I am familiar with it	69	37.30	53	49.53
HQ	I associate good memories/ experiences with it	46	24.86	22	20.56
PQ	It is practical	41	22.16	37	34.58
PQ	It has a simple handling	33	17.84	26	24.30
PQ	It is/was affordable	8	4.32	1	0.93

Note. HQ = Hedonic quality, PQ = Pragmatic quality, - = could not be clearly attributed; multiple choices were allowed without any maximum limit

For both user groups, the car's appearance, driving experience, and good equipment were the most often selected reasons for this attachment. Other often selected reasons included: brand, safety, and that the car fits the user. Lessees also frequently mentioned comfort and modernity. Less often, reasons were affordability, ease of handling, practicality for owners, and ownership for lessees. The presence of hedonic reasons was cited more frequently than pragmatic reasons for emotional attachment. Similarly, the absence of hedonic qualities was mentioned more often as a cause for weak emotional attachment than the absence of pragmatic qualities. Owners (*n* = 57) and lessees (*n* = 61) who lacked emotional attachment often cited

the car as a utility object (owners: *n* = 32, 56.14%; lessees: *n* = 24, 39.34%) or a lack of special memories (owners: *n* = 22, 38.60%; lessees: *n* = 20, 32.79%). For lessees, not owning the car was also a barrier to attachment (*n* = 18, 29.51%).

3.5.3 Discussion

The first preliminary study reveals a significant difference in emotional attachment between car owners and lessees, with owners exhibiting a stronger attachment to their cars. This finding aligns with our theoretical framework and is consistent with existing literature on car ownership and emotional attachment. The emotions associated with car ownership are predominantly positive, including satisfaction, amusement, and pride. Notably, owners tend to form stronger memories with their cars and feel more connected to other car owners than lessees. One possible reason for this finding may be the duration of possession; owners generally keep their cars for longer periods than lessees. This should allow them to create more memories, although the data in this study do not provide insight into usage duration. Interestingly, we find no significant differences in self-expression between owners and lessees. However, our sample consists exclusively of car users from the same premium brand, which may limit the generalizability of our findings to other car brands and user groups. Furthermore, the homogeneity of our sample and the lack of data from car-sharing users restrict the applicability of our results. Therefore, a preliminary study 2 with a more diverse sample is conducted.

3.6 Preliminary study 2

3.6.1 Study design and sample

The second preliminary study aimed to expand the sample to include car sharing users and to increase the diversity of car brands represented. It was done as a partnership project between several departments of the first and second author’s company. However, as the topic here was part of a larger online questionnaire covering various topics from different stakeholders, we faced limitations regarding the number of our questions and the sample requirements. Consequently, we could only put a selection of the questions necessary to address our research questions comprehensively. Neither data on usage duration nor reasons for and against emotional attachment could be collected. Additionally, the determinant of group affiliation in the PAS had to be omitted.

The study was conducted in July 2022 in Germany with the three-level variable 'user group' (owners, lessees, and car sharing users) and the two-level variable 'car class' (premium and volume cars). To be classified as a car sharing user, individuals needed to use car sharing services at least once a month. It was not required for them to use car sharing services exclusively, and they may additionally have owned or leased a personal car. However, participants of the car sharing group were instructed to respond to all questions concerning their mostly used car sharing car, ensuring that their responses reflected their experiences and attitudes towards car sharing specifically. The allocation to the car class groups was based on the car brand (for details, see Appendix B.) (Autohaus, 2024; Dudenhöffer, 2014; Munoz, 2023.; Pankow, 2018; Premiummarke, 2024; Rosengarten & Stürmer, 2004). An external agency conducted the recruitment and the incentivization of participants. The participants were contacted via email and invited to answer an online questionnaire. An ethics review revealed no concerns. A total of N = 500 participants were recruited. However, 13 participants were excluded because they could not be assigned to a user group. The final sample consisted of 487 participants (n = 246 males, n = 240 females, and n = 1 without indication). The number of participants per group is presented in Table 15. The participants' mean age was M = 44.95 years (SD = 11.98).

Table 15

Number (n) of participants by user group and car class (preliminary study 2)

	Premium	**Volume**
Owning	99	215
Leasing	23	76
Car sharing	36	38

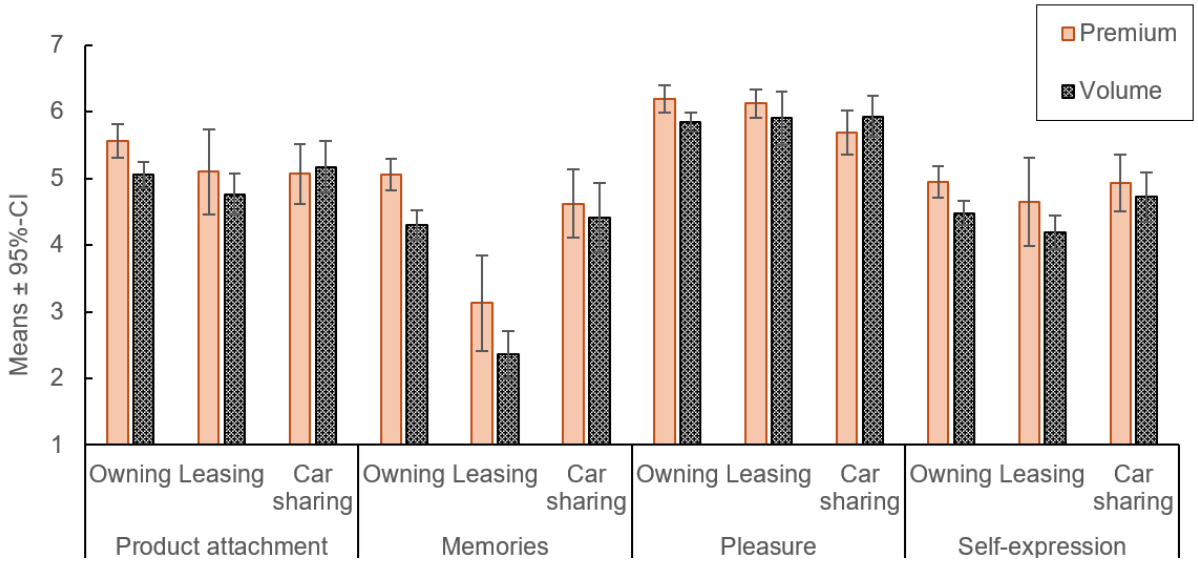
The participants first completed questions for user group assignment and were then asked to fill out the PAS and IOS scale. Due to time restrictions, we omitted the items related to group affiliation to cover all hedonic dimensions. Completing our section of the questionnaire took 5-10 minutes.

3.6.2 Results

Figure 8 presents the mean PAS values for the user groups (owners, lessees, and car sharing users) by car class (premium vs. volume cars).

Figure 8

Mean values for the determinants of the PAS by user group and car class (preliminary study 2)



Note. Mean values for product attachment and the determinants memories, pleasure, and self-expression according to the user groups owning, leasing, and car sharing and according to car class (premium vs. volume cars). Error bars show 95%-confidence intervals.

Product attachment, pleasure, and self-expression results were in the middle to upper range of the scale, with owners and lessees of premium cars showing slightly higher values than users of volume cars. In terms of memories, larger differences were evident: Owners and car-sharing users scored in the middle to upper range of the scale, with owners of premium cars tending to associate more memories with their cars than owners of volume cars. Lessees reported fewer memories associated with the car compared to the other two user groups, particularly if they leased a volume car.

A two-factorial MANOVA showed statistically significant differences for the user groups (Wilk's $\Lambda = .805$, $F(8, 956) = 13.70$, $p < .001$, partial $\eta^2 = .103$) and car classes (Wilk's $\Lambda = .974$, $F(4, 478) = 3.146$, $p = .014$, partial $\eta^2 = .026$) for the combined dependent variables. There was no indication of an interaction effect (Wilk's $\Lambda = .988$, $F(8, 956) = 0.754$, $p = .644$).

The two-factorial ANOVA revealed a significant main effect of 'user group' for memories ($F(2, 481) = 42.44$, $p < .001$, partial $\eta^2 = .150$). The differences could be attributed to lessees, who associated fewer memories with the car compared to

owners (-2.00, 95%-CI[-2.43, -1.57], $p < .001$) and car sharing users (-1.98, 95%-CI[-2.55, -1.40], $p < .001$). Additionally, a main effect was observed for 'car class' for memories ($F(2, 481) = 9.58$, $p = .002$, partial $\eta^2 = .020$) and self-expression ($F(2, 481) = 6.12$, $p = .014$, partial $\eta^2 = .013$). A Welch's *t*-test revealed a significant difference for memories between premium car owners and volume car owners ($t(263.95) = 4.556$, $p < .001$, $d = 0.486$). No significant differences were found among lessees ($t(97) = 1.993$, $p = .098$) and car sharing users ($t(72) = 0.544$, $p = .588$). Furthermore, premium car owners reported a higher level of self-expression through their car than volume car owners ($t(312) = 2.923$, $p = .012$, $d = 0.355$). However, no significant differences in self-expression were observed among lessees ($t(97) = 1.519$, $p = .264$) and car sharing users ($t(72) = 0.727$, $p = .470$) across different car classes.

The means of the IOS scale by user group and car class are presented in Table 16. Owners showed the highest values, followed by lessees and car sharing users. All values were in the upper range of the scale. The assumptions for a two-factorial ANOVA were met. The interaction effect between 'user group' and 'car class' was not significant ($F(2, 481) = 0.11$, $p = .898$). Additionally, there was no indication of a significant influence of 'car class' ($F(1, 481) = 2.87$, $p = .091$). However, the user groups differed significantly ($F(2, 481) = 17.86$, $p < .001$, partial $\eta^2 = .069$): Owners had a higher attachment to their car compared to lessees (0.70, 95%-CI[0.27, 1.13], $p < .001$) and car sharing users (1.10, 95%-CI[0.62, 1.58], $p < .001$).

Table 16

Means (M) and standard deviations (SD) of Inclusion of the other in the self (IOS) scale by user group and car class (preliminary study 2)

	Premium		**Volume**	
	M	***SD***	***M***	***SD***
Owning	5.52	1.50	5.13	1.59
Leasing	4.83	1.61	4.46	1.73
Car sharing	4.25	1.59	4.05	1.47

3.6.3 Discussion

The second preliminary study replicates findings of preliminary study 1, indicating that owners exhibit a stronger emotional attachment to their cars than lessees. This is particularly evident in the differences between user groups regarding memories and

experiences associated with the car. This study expanded the sample by incorporating the user group 'car sharing' and examining 'car class' as an additional variable. The results indicate that lessees tend to associate fewer memories with their cars compared to owners and car sharing users. Owners of premium cars reported stronger associated memories with their car and a greater sense of self-expression through their car compared to owners of volume cars. Although descriptive statistics suggest a similar effect among lessees, this difference did not reach statistical significance, potentially due to the smaller sample size. Among car sharing users, no differences were observed across different car classes.

However, this study could not assess all variables, and no specific requirements regarding the sample could be made. Therefore, we conducted the main study to address these limitations and provide a more comprehensive understanding of the relationships between car ownership, car class, and emotional attachments.

3.7 Main study 3

3.7.1 Study design and sample

The main study 3 addressed the limitations of the two studies before: The sample was now recruited according to our specifications, and we were able to address all questions. It took place online in March 2023 in Germany with the three-level variable 'user group' (owners, lessees, and car sharing users) and the two-level variable 'car class' (premium and volume cars).

An external agency conducted the recruitment and incentivization of participants. The target group consisted of German-speaking individuals between the ages of 25 and 65, with a balanced distribution of user groups. To be classified as a car sharing user, individuals again needed to use car sharing services at least twice a month. It was not a requirement to use car sharing services exclusively, they may have also owned or leased a personal car. However, participants of the car sharing group were instructed to respond to all questions regarding their car sharing car. Potential participants were contacted via email and invited to answer an online questionnaire, which took 10-15 minutes to complete. An ethics review revealed no concerns. Out of the total N = 600 participants, eight were excluded due to suspicious click behavior. Table 17 presents the gender-specific distribution, assignment to car class (which was conducted post hoc based on the car brand), and the means of usage duration. The

mean age for owners was *M* = 41.83 (*SD* = 13.77), for lessees *M* = 37.49 (*SD* = 11.53), and for car sharing users *M* = 38.63 (*SD* = 11.13).

Table 17

Number of participants by gender and car class, and the mean (M) and standard deviation (SD) of usage duration, all categorized by user group

	Gender			Car class		Usage duration in years	
	male	**female**	**not specified**	**Premium**	**Volume**	***M***	***SD***
Owning	100	100	0	73	127	4.26	3.99
Leasing	92	104	0	104	92	1.76	2.39
Car sharing	100	88	8	125	71	2.69	3.98

At the beginning of the survey, participants were informed about the purpose and duration of the study. They were instructed to respond spontaneously. The assurance of data anonymity was emphasized. Subsequently, questions were asked to assign participants to user groups and to determine the specific car (make, model, year) and how long they had owned it (years and months). They were then asked to complete the PAS and IOS scales. Finally, participants were asked to rate their emotional attachment to the car and select up to three reasons for this attachment. In the end, participants were thanked for their participation.

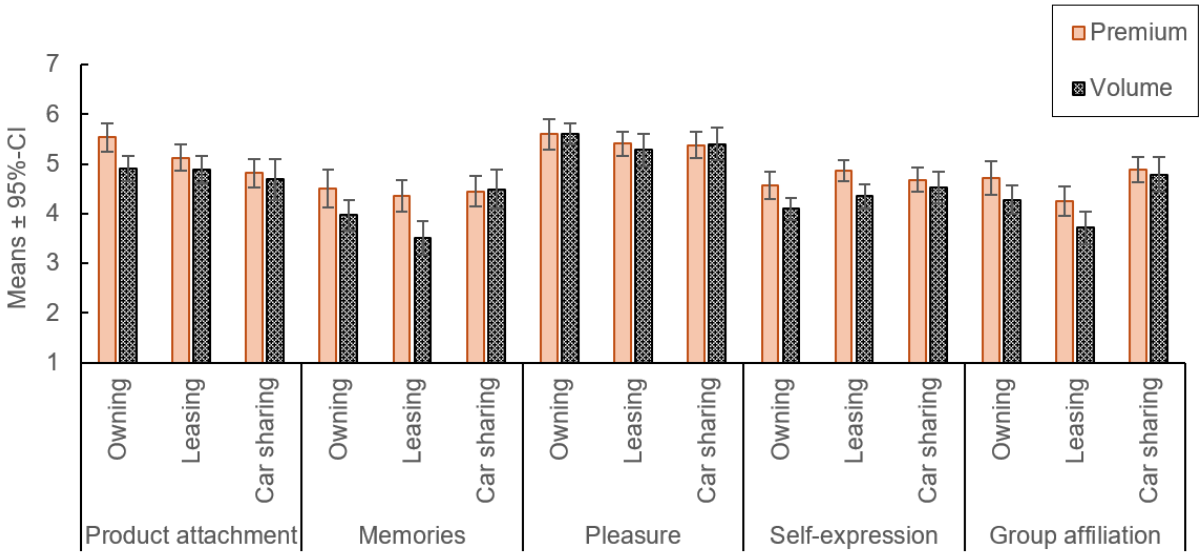
3.7.2 Results

Emotional Attachment

Figure 9 shows the mean values of the PAS determinants by user group (owners, lessees, and car sharing users) and car class (premium vs. volume cars).

Figure 9

Mean values for the determinants of the PAS by user group and car class (main study 3)



Note. Mean values for product attachment and the determinants memories, pleasure, self-expression, and group affiliation according to the user groups owning, leasing, and car sharing and according to car class (premium vs. volume cars). Error bars show 95%-confidence intervals.

The MANOVA showed statistically significant differences between the user groups (Wilk's $\Lambda = .777$, $F(10, 1164) = 15.676$, $p < .001$, partial $\eta^2 = .119$), car classes (Wilk's $\Lambda = .933$, $F(5, 582) = 8.330$, $p < .001$, partial $\eta^2 = .067$), and their interaction for the combined dependent variables (Wilk's $\Lambda = .946$, $F(10, 1166) = 3.257$, $p < .001$, partial $\eta^2 = .027$). Post-hoc two-way ANOVAs were conducted for each dependent variable and are shown in Table 18. The results of the post-hoc Tukey-Kramer comparisons for the user groups are shown in Table 19.

Table 18

Test of between-subjects effects (main study 3)

	Dependent variable	*df*	*F*	*p*	η²
User group	Product attachment	2	20.29	< .001*	.065
	Memories	2	5.42	.005*	.018
	Pleasure	2	1.85	.158	.065
	Self-expression	2	0.50	.608	.000
	Group affiliation	2	14.47	< .001*	.047
Car class	Product attachment	1	18.67	< .001*	.031
	Memories	1	7.00	.008*	.012
	Pleasure	1	0.85	.771	.000
	Self-expression	1	20.88	< .001*	.034
	Group affiliation	1	7.28	.007*	.012
User group * car class	Product attachment	2	1.676	.188	.006
	Memories	2	3.15	.044*	.011
	Pleasure	2	0.15	.861	.001
	Self-expression	2	2.92	.055	.010
	Group affiliation	2	1.00	.368	.003
Error	Product attachment, Memories, Pleasure, Self-expression, Group affiliation	586			

*Note. *p < .05*

Table 19

Multiple Comparisons (Tukey-HSD)

Dependent variable	Comparison	Mean difference	Standard error (*SE*)	Sig.	95%-CI	
					LL	UL
Product attachment	Owning – Leasing	0.18	0.14	.404	-0.15	0.52
	Owning – Car sharing	0.75	0.14	<.001*	0.41	1.08
	Leasing – Car sharing	0.56	0.14	<.001*	0.23	0.90
Memories	Owning – Leasing	0.42	0.17	.029	0.03	0.81
	Owning – Car sharing	-0.04	0.17	.965	-0.43	0.35
	Leasing – Car sharing	-0.47	0.17	.015*	-0.86	-0.07
Pleasure	Owning – Leasing	0.26	0.14	.162	-0.59	0.07
	Owning – Car sharing	0.22	0.14	.269	-0.11	0.55
	Leasing – Car sharing	-0.04	0.14	.958	-0.37	0.29
Self-expression	Owning – Leasing	-0.24	0.13	.149	-0.54	0.60
	Owning – Car sharing	-0.24	0.13	.144	-0.54	0.06
	Leasing – Car sharing	-0.00	0.13	1.000	-0.30	0.30
Group affiliation	Owning – Leasing	0.44	0.16	.014*	0.07	0.80
	Owning – Car sharing	-0.41	0.16	.023*	-0.78	-0.05
	Leasing – Car sharing	-0.85	0.16	<.001*	-1.22	-0.48

*Note. *p* < .05

Product attachment. Owners and lessees exhibited values in the upper range of the scale of product attachment, while car sharing users scored in the medium range. For the dependent variable 'Product attachment', both main effects of 'user group' (F(2, 586) = 20.29, p < .001, partial η² = .065) and 'car class' (F(1, 586) = 18.67, p < .001, partial η² = .031) were significant. Thus, overall the attachment to premium cars was higher than to volume cars. Owners (t(180.32) = 4.11, p < .001) and car sharing users (t(194) = 2.40, p = .034) felt significantly more attached to a premium car than to a volume car. Lessees did not show significant differences (t(194) = 1.23, p = .222). Additionally, differences were found regarding the user group: owners (0.75, 95%-CI[0.41, 1.08], p < .001) and lessees (0.56, 95%-CI[0.23, 0.90], p < .001) showed a stronger emotional attachment to the car than car sharing users. There was no evidence of a significant interaction effect.

Memories. The memories associated with the car were in the upper range of the scale for all groups. Only lessees of volume cars scored slightly lower. For the dependent variable memories, a significant interaction term was found (F(2, 586) = 3.15, p = .044, partial η² = .011). Thus, the association of memories with either a premium or volume car depends on the user group. Post-hoc analyses showed lessees associated more memories with their premium car than with a volume car (F(1,194) = 13.11, p < .001, partial η² = .063). For the other two groups, there was no evidence of differences between car classes (p > .05).

Pleasure. The pleasure experienced with the car was in the upper scale range for all groups. There was no evidence of significant differences between user groups or car class, nor was there a significant interaction term.

Self-expression. All groups reported values in the upper scale range regarding self-expression, with users of premium cars scoring slightly higher than users of volume cars. There was no evidence of differences between user groups. The interaction term slightly missed significance (F(2, 586) = 2.92, p = .055). However, there were significant differences for the car class: Owners (t(178.12) = 4.65, p < .001) and lessees (t(194) = 3.11, p = .004) of a premium car felt more able to express themselves through the car than those who owned or leased a volume car. There was no difference for car sharing users (t(194) = 0.75, p = .455)

Group affiliation. Owners of premium cars and car sharing users achieved values in the upper scale range regarding group affiliation. Owners of volume cars and lessees of premium cars achieved values in the mid-range, as did, although lower level, lessees of volume cars. Both main effects of 'user group' ($F(2, 586) = 14.47$, $p < .001$, partial $\eta^2 = .047$) and 'car class' ($F(1, 586) = 7.28$, $p = .007$, partial $\eta^2 = .012$) were significant. Car sharing users achieved higher values regarding group affiliation than owners and lessees, and owners scored higher than lessees. Additionally, the feeling of group affiliation was higher with premium cars than with volume cars. This effect was especially significant among lessees ($t(194) = 2.34$, $p = .040$). There was no evidence of a significant interaction effect.

Regarding the IOS, owners of premium cars scored the highest ($M = 5.59$, $SD = 1.36$). Owners of volume cars ($M = 4.58$, $SD = 1.94$), lessees (premium: $M = 4.93$, $SD = 1.69$; volume: $M = 4.63$, $SD = 1.78$), and car sharing users (premium: $M = 4.57$, $SD = 1.57$; volume: $M = 4.03$, $SD = 1.42$) scored less high.

The ANOVA showed both main effects, 'user group' ($F(2,586) = 10.33$, $p < .001$, partial $\eta^2 = .034$) and 'car class' ($F(1,586) = 19.04$, $p < .001$, partial $\eta^2 = .031$) were significant. Car sharing users felt less strongly connected to the car than owners (-0.58, 95%-CI[-0.97, -0.18], $p = .002$) and lessees (-0.42, 95%-CI[-0.82, -0.02], $p = .036$). In addition, participants who used premium cars felt closer to their car than those who used volume cars. This was significant for owners ($t(189.97) = 4.29$, $p < .001$) and car sharing users ($t(194) = 2.39$, $p = .036$). Lessees did not show differences between the car classes ($t(194) = 1.22$, $p = .225$). There was no evidence of a significant interaction effect.

Reasons for an Emotional Attachment. 146 owners, 155 lessees, and 161 car sharing users reported feeling emotionally attached to their cars. Table 20 presents the collected reasons for an emotional attachment.

Table 20

Number (n) and percentage (%) of participants mentioning reasons for an emotional attachment, categorized by user group (main study 3)

Product Quality	Reason	Owner		Leasing		Car sharing	
		n	%	*n*	%	*n*	%
PQ	It makes me independent	42	28.77	26	16.77	17	10.56
HQ	It is mine	42	28.77	12	7.74	15	9.32
PQ	It works reliably	35	23.97	31	20.00	26	16.15
HQ	The driving experience	33	22.60	28	18.06	47	29.19
HQ	I associate good memories/ experiences with it	30	20.55	18	11.61	33	20.50
HQ	It looks beautiful	27	18.49	29	18.71	13	8.07
HQ	It suits me	24	16.44	32	20.65	37	22.98
-	It is comfortable	23	15.75	27	17.42	39	24.22
PQ	It is practical	21	14.38	20	12.90	27	16.77
PQ	It is safe	21	14.38	26	16.77	25	15.53
PQ	It has a good size	18	12.33	13	8.39	9	5.59
HQ	I like the brand	17	11.64	28	18.06	20	12.42
-	I am familiar with it	17	11.64	16	10.32	28	17.39
HQ	It is fast/powerful	15	10.27	16	10.32	21	13.04
HQ	It is modern	15	10.27	31	20.00	20	12.42
PQ	It is/was affordable	13	8.90	14	9.03	9	5.59
-	It has great features	13	8.90	23	14.84	16	9.94
PQ	It has a simple handling	8	5.48	23	14.84	24	14.91

Note. HQ = Hedonic quality, PQ = Pragmatic quality, - = could not be clearly attributed; multiple choices were allowed, with a limit of three answers

Owners particularly valued independence, a sense of personal ownership, reliability, and driving experience. Less frequently selected were ease of use, a low price, and special features. Lessees valued a personalized fit, modernity, and reliability. Less often considered were the size of the car, a low price, familiarity with the car, and the feeling of ownership. Car sharing users prioritized driving experience, a personalized fit, and comfort. Similarly to lessees, size and low price were less important. Additionally, car sharing users placed less emphasis on the car's aesthetics.

Overall, all groups cited more hedonic reasons for emotional attachment than pragmatic reasons. Hedonic reasons were also more frequently mentioned than pragmatic reasons for the lack of emotional attachment. Across all groups, participants without emotional attachment to their cars primarily viewed the car as a utilitarian object (owners: n = 40, 90.91%; lessees: n = 24, 61.54%; car sharing users: n = 14, 41.18%) – hedonic aspects of the car were not a priority for them. Another significant

reason for the lack of emotional attachment was the absence of special memories or experiences with the car, particularly for owners (*n* = 21, 47.73%) and lessees (*n* = 14, 35.90%). For car sharing users (*n* = 15, 44.12%) and lessees (*n* = 11, 28.21%), the fact that the car was not their own played a major role. Additionally, car sharing users mentioned they could not choose the car (*n* = 12, 35.29%).

Duration of Usage. After excluding extreme outliers (> 3 IQR), the following mean values were obtained: owners (*N* = 194) had owned their cars for an average of 3.84 years (*SD* = 3.21), lessees (*N* = 191) had leased their cars for an average of 1.47 years (*SD* = 1.33), and car sharing users (*N* = 188) had used car sharing services for an average of 2.07 years (*SD* = 1.76).

The results indicate that product attachment initially increases with duration for both owners and lessees. After roughly 1.5 years, the attachment level for owners reaches a plateau, in contrast to lessees, whose attachment level begins to diminish after approximately 0.75 years. However, a notable upturn in product attachment was observed for owners who had possessed their cars for more than seven years. In contrast, car sharing users exhibited a relatively stable level of product attachment, which only declined after more than 3.5 years of usage. The IOS scale showed a similar pattern, although lessees exhibited a stronger downward trend. To examine the statistical significance of the relationships between product attachment, memories, pleasure, self-expression, group affiliation, and duration, bivariate correlations between duration and the other variables were calculated for each user group. The detailed statistics are presented in Table 21.

Table 21

Bivariate correlations (r) of duration of usage with the determinants of product attachment by user group

		Product attachment	**Memories**	**Pleasure**	**Self-expression**	**Group affiliation**
Owning	*r*	.072	.142*	.097	.036	.022
	sig.	.316	.048	.177	.615	.759
Leasing	*r*	-.100	-.081	.047	-.077	-.117
	sig.	.169	.265	.521	.291	.106
Car sharing	*r*	-.072	-.033	.267*	.139	.150*
	sig.	.329	.649	<.001	.075	.040

Note. * $p < .05$, correlation variable: 'duration' of usage

For owners, participants reported slightly more memories with increasing ownership duration. No significant correlations between duration and the other variables were found for lessees. For car sharing users, duration correlated moderately positively with pleasure and had a slight positive correlation with group affiliation.

3.8 Discussion

The main study 3 was designed to address the methodological limitations of the preliminary studies and to recruit a heterogeneous sample with balanced user groups. The findings of this study partially replicate those of preliminary studies 1 and 2, showing that emotional attachment to cars differs across user groups and car classes. Additionally, the main study 3 extends previous research by examining the role of usage duration. Our findings are summarized below and contextualized within the broader literature. We conclude with the limitations and implications of this study.

3.8.1 Emotional attachment to the car depending on the user group and car class

Most participants report an emotional attachment to their cars. Moreover, cars are predominantly associated with positive emotions such as satisfaction, amusement, and pride. These findings align with previous research (Grund et al., 2025b; Sheller, 2004; Steg, 2005), confirming the car to be associated with emotions on a high level. Our results show owners exhibit the strongest attachment, followed by lessees. Car sharing users show the weakest, but still evident, attachment. Emotional attachment to premium cars surpasses that of volume cars, which is consistent with Lantos (2007) and Park et al. (2006).

When examining the determinants of product attachment, we find that lessees of volume cars form fewer memories associated with their cars than lessees of premium cars and the other user groups. This could be because lessees frequently change cars; thus premium cars are more likely to be remembered (Min, 2018). Conversely, car sharing users associate memories with their cars regardless of the class. This might be attributed to using these cars for specific occasions, linking them to high involvement experiences rather than to daily routines (Grund et al., 2025b; Steg, 2005).

Pleasure is strongly associated with cars across all user groups and car classes. Self-expression is primarily linked to premium cars, aligning with previous research suggesting premium products are used to convey self-image (Belk, 1988; Vigneron & Johnson, 1999). This effect occurs primarily among owners and lessees, while car sharing users express themselves regardless of the car class. This may be due to their desire to convey a sustainable and social lifestyle, achievable through car sharing regardless of the car type (Schaefers, 2013). This could also explain why car sharing users report the highest sense of group affiliation, while lessees feel the least connected to their respective group. Furthermore, our findings suggest that both owners and lessees of premium cars exhibit a stronger sense of group affiliation than those of volume cars. This is consistent with the results of Kotler et al. (2017) and Holmqvist (2015), indicating that ownership of a premium product can contribute to a sense of belonging to a distinct group of successful and entrepreneurial individuals.

3.8.2 Factors contributing to or hindering an emotional attachment to the car

Our findings indicate the absence of hedonic values often cited as a reason for a low or nonexistent emotional attachment to the car. Especially, the lack of memories and experiences was frequently mentioned because the absence of a shared history could hinder the development of an emotional attachment. This aligns with Grund et al. (2025b) and Steg (2005). In conclusion, this underscores the importance of hedonic values for brands that aim to establish product attachment, thereby supporting the assertions made by Winder (2006).

Furthermore, our study reveals that the lack of ownership can hinder the formation of an emotional attachment, as car sharing users often cited this. This finding is consistent with Bardhi and Eckhardt (2012), who stated car sharing users do not develop a sense of ownership or identification with the car. Previous research suggests that car sharing users prioritize more pragmatic aspects of a car (Bardhi & Eckhardt, 2012) and the relationship to a car sharing car is primarily pragmatic (Schaefers, 2013). However, our results do not support this by showing car sharing users also value hedonic aspects of a car. One reason for this may be the sharing aspect, as it influences the assessment of attachment to the car. However, we were unable to separate this effect with our data.

3.8.3 Emotional attachment to the car over time

Using a cross-sectional approach, we investigated emotional attachment as a function of usage duration. For owners and lessees, attachment initially increases, which aligns with Grund et al. (2025b). This may reflect an initial "infatuation phase" where users are primarily stimulated by the car's novelty (Hassenzahl, 2006). Subsequently, the curve declines, potentially due to a waning novelty effect (Hassenzahl, 2006). While the usage time ends for lessees at this point, the curve for owners increases again, which could be attributed to increasing memories and identification (Karapanos, 2013). The positive correlation with memories supports this.

In contrast, the curve for car sharing users shows a downward trend from the outset, contradicting previous research (Grund et al., 2025b). However, it is worth noting that Grund et al. (2025b) investigated car sharing users who utilized a station-based car sharing service, where users typically used the same car. This may have fostered a stronger emotional attachment to the car, as users had more opportunities to develop a sense of familiarity and ownership. In contrast, our studies examined car sharing users who may have used various cars, potentially contributing to the downward trend in attachment over time. The positive correlation between pleasure and group affiliation with usage time suggests that car sharing users may derive emotional benefits from the social aspects of car sharing, such as feeling part of a community or enjoying the experience of driving different cars. However, this attachment may not be strong enough to offset the lack of emotional investment in the car itself, resulting in a downward trend in attachment over time.

3.8.4 Implications

Our research offers insights into the emotional aspects of car ownership and use. It emphasizes the importance of considering these factors when developing car functionalities, marketing strategies, and mobility services. By understanding the various foundations of emotional attachment among different user groups, providers can create tailored marketing efforts and services that effectively target and engage their desired audience, ultimately driving business success. The reported research complements existing studies on emotional attachments to cars by providing quantitative evidence, thereby highlighting the statistical significance of the complexities involved in emotional attachments.

Hereinafter, practical implications for car design, marketing strategies, and service providers are derived regarding how to enhance the emotional attachment of car users by preventing car-related emotional experiences. Based on the results of the studies, the suggestions are structured around relevant factors such as lasting memories, stimulation through novelty, sustainability and social senses, as well as personalization and customization. The recommendations pertain to the different user groups of car ownership, usage patterns, and car classes.

- Memories by lasting experiences: The car should support the creation of lasting memories and experiences. For that purpose, automakers could allow users to save photos or specific routes to generate long-lasting memories. Especially car owners who have owned their car for a long time and have a strong emotional attachment, should benefit from accumulating numerous memories with the car. For lessees, memories play a subordinate role.
- Stimulation by novelty: The car itself, as well as marketing campaigns, should highlight the car's latest features and technologies. Particularly, lessees of premium cars seem to be most attached to the car through stimulation by its modernity and novelty. Furthermore, regular updates could be offered to maintain initial enthusiasm and to prevent the attachment curve from declining over time.
- Sustainability and social senses: Independent of the car class used, car sharers are mostly attached to their car by sustainable and unique social experiences. For that, car sharing providers may benefit from emphasizing the sustainable and social aspects of their services, as well as the unique experiences and sense of community that they offer. In contrast, it may not be necessary for car sharing providers to offer premium cars.
- Personalization and customization: Automakers and car sharing providers should consider the role of personalization and customization in creating emotional attachments. For this purpose, digital assistants in the car could personally greet the owner, lessees, and the car sharer and save their preferences and settings, seamlessly adapting the car to the user upon subsequent use. By offering personalized services, exclusive events, and tailored experiences, providers can create a sense of ownership and attachment among all user groups, even if they

do not possess the car. However, it could be beneficial if car sharing users had more freedom in selecting their cars.

In addition to car designers, marketers, and car sharing providers, the development of autonomous vehicles and mobility-as-a-service (MaaS) platforms will require a deep understanding of the emotional aspects of car ownership and usage. By considering the emotional needs and desires of users, providers can create services that not only meet their functional needs but also provide a sense of emotional fulfillment and attachment.

Besides the practical implications given above, the findings have scientific implications for future research in the field of traffic and transport psychology and mobility as discussed below.

3.8.5 Limitations and future work

Preliminary study 1 investigated both owners and lessees across various determinants of product attachment, emotions associated with the car, and reasons for or against an emotional attachment to the car. However, this study was characterized by a highly homogeneous sample, thereby limiting its generalizability. Neither car sharing users nor various car classes could be examined. In preliminary study 2, a more heterogeneous sample was recruited, allowing us to investigate all relevant groups. Nevertheless, this study was constrained by different group sizes and insufficient time resources to address the research questions comprehensively. Data on usage duration and reasons for and against emotional attachment could not be collected. Moreover, the determinant of group affiliation in the PAS had to be omitted. Consequently, the main study 3 was needed to overcome the limitations of the preliminary studies.

The main study 3 also assigned participants to car classes post-hoc, leading to unequal group sizes. Furthermore, the car class assignment was based solely on the car brand, which aligns with the definition but may overlook nuances. A new volume car could potentially have a higher social image or be perceived as more stimulating than an older, used premium car. Additionally, the user's income could play a role. A user with comparatively low income may need to save for a volume car for a duration similar to that of a high-earning user purchasing a premium car. Therefore, future

research should consider the age of the car, various models within a brand, and the socioeconomic status of the user, as these factors could influence car perceptions.

In the items related to group affiliation, we considered the respective user group (owning, leasing, or car sharing). However, users may identify more with other groups, such as car class or car brand (e.g., Audi drivers). Future research could focus on which reference groups shape the sense of belonging within the various user groups.

The studies focus exclusively on quantitative data. Particularly concerning emotional attachments, it is possible that additional factors, such as the car's price relative to income or its age, may influence attachment. However, these factors were not accounted for in the present study. Nevertheless, it is crucial to substantiate qualitative insights to enhance the generalizability of findings statistically. A mixed-methods approach is recommended for future research in this context.

Moreover, this study adopted a cross-sectional design, excluding the examination of intra-individual differences. Consequently, it was not feasible to investigate various use phases within the user groups. Notably, the initial contact or the end of the usage could not be depicted. Therefore, a longitudinal or retrospective approach is suggested for investigating emotional attachments over time.

Additionally, the studies were conducted in Germany, and emotional attachment to cars may vary across cultures due to differing values, car usage patterns, and social norms. Future research should thus accord greater attention to cultural factors to obtain a more comprehensive understanding of emotional attachment to cars.

3.9 Conclusion

This research confirms the car as an emotional object and demonstrates that the emotional attachment to the car and its determinants differ between the user groups and car classes. Owners experience a higher level of emotional attachment than lessees or car sharing users, although the latter also showed considerable attachment. The findings also indicate that premium car users generally exhibited higher scores, suggesting a stronger emotional attachment. This study contributes to a better understanding of emotional attachments to cars by quantitatively examining qualitative insights from previous research and introducing car class as an influential variable. Understanding emotional attachments is key to influencing user behavior, as emotional behavior is often not rationally explainable. From this understanding, we

derived implications for the automotive industry and further consumer research in emotional product attachment, focusing on fostering a positive human-car relationship.

4. Fostering Emotional Attachments to Cars: Insights from a Focus Group Study

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Title of paper:		Fostering Emotional Attachments to Cars: Insights from a Focus Group Study			
Status in publication process:		published			

* Recruiting of participants and moderating of the study were carried out by Move Research GmbH.

Abstract

The emotional attachment between users and products is shaped by pragmatic and hedonic qualities. Their influence and importance change over time and vary across products. While different user groups (owners, lessees, car sharing users) form emotional attachments to cars, the relevance of these product qualities throughout a car's lifecycle (familiarization, everyday use, malfunctions, farewell) is unknown.

This study aims to provide approaches to strengthening emotional attachment at each use phase for every user group, considering modern technologies such as digital assistants. Six focus groups were conducted, each with five to six participants who have an emotional attachment to their car. Different ideation methods were used.

According to the results, owners focus on ideas that increase identification with their car during the familiarization phase. Over time, they prefer stimulating approaches, while creating memories is always important to them, especially not losing those memories when they part with the car. Lessees prefer stimulating ideas from the beginning and stimulation remains important throughout the lifecycle, while car sharing users prefer pragmatic and cost-oriented concepts. For all user groups, it is important to personalize the car experience to increase identification. Digital assistants are therefore seen as a potential tool. They can also anticipate user needs and facilitate memory transfer between cars.

4.1 Background

4.1.1 Emotional product attachment

People can form attachments not only with other people, but also with brands or objects (Page, 2014; Park et al., 2010). Because of that, emotions might play an important role in purchase decisions and brand loyalty. Moreover, users might also experience long-term enjoyment of a product through an emotional attachment (Diefenbach & Hassenzahl, 2017).

Hassenzahl (2005) divided product qualities into two categories: *hedonic* and *pragmatic.* Both qualities influence product evaluation and emotional attachment. Pragmatic qualities, such as usability and utility, are related to the user's immediate goal attainment. In contrast, hedonic qualities focus on the user's subjective feelings when expecting, doing, or reflecting on interaction with the product. They consist of three dimensions: (1) s*timulation*, which describes the motivational effect of the product through novelty, excitement and curiosity; (2) *evocation*, which measures the product's ability to evoke personal memories and emotions in the user; and (3) *identification*, which refers to the user's tendency to attach individual value to the product and express himself or herself through its use. The more a product can be assigned to the hedonic dimension, the stronger the emotional attachment (Winder, 2006).

Hassenzahl's (2005) model of hedonic product qualities is partially consistent with Mugge's (2007) findings on emotional product attachment. Mugge (2007) identified four determinants contributing to the user's emotional attachment to a product. (1) *Self-expression* describes the user's need to differentiate himself or herself from others through the product and to express his or her own identity. It corresponds in part to Hassenzahl's (2005) concept of identification. (2) *Memories* focus on the product's ability to evoke positive memories and emotions in the user. It parallels Hassenzahl's (2005) dimension of evocation. (3) *Pleasure* describes the immediate pleasure and positive mood the user feels when interacting with the product. It is not explicitly included in Hassenzahl's (2005) model but can be interpreted as part of stimulation. (4) *Group affiliation* refers to the user's need to feel part of a social group and to experience recognition and acceptance through the product. It has no direct equivalent in Hassenzahl's (2005) model but could be seen as an extension of the concept of identification.

4.1.2 Factors influencing emotional product attachment

Considering emotional product attachment an important factor is time. Value perceptions are not static but change over time. Hedonic qualities show more change than pragmatic qualities, which remain more constant (Wilamowitz-Moellendorff et al., 2007). According to Mugge et al. (2005), the dynamic nature of product loyalty can arise through adding or omitting determinants (e.g., memories associated with the product). The attractiveness may decrease if the product loses novelty (Hassenzahl, 2006) – but may increase as the product becomes better known and more familiar to the user (Hassenzahl, 2006). In addition, the number of memories and the identification with the product increase over time (Karapanos, 2013). Repeated interactions, positive associations, and evoked memories lead to lasting positive feelings towards a product (Norman, 2005). Positive memories are particularly important for product loyalty (Mugge et al., 2005). As product-related memories are positively correlated with the degree of product attachment, it can be assumed that product loyalty may also increase over time (Mugge et al., 2005). Kujala et al. (2011) found the most substantial changes in product attractiveness at the beginning of the usage. This is in line with the findings of Pettersson (2016), who described the first impression as particularly formative for later product loyalty. However, studies showed that the attractiveness curves over time can vary for different product categories (Wilamowitz-Moellendorff et al., 2007).

Another factor influencing emotions and product attachment is digital products, such as avatars and digital assistants. Studies in human-technology interactions involving a digital assistant showed that users can identify with this non-human object, similar to how they identify with other people (Gelbrich et al., 2021). Duggan (2016) investigated two versions of a digital assistant as a companion in a 30-day fitness program. The version that used relational strategies such as small talk, expressions of empathy, and humor was more respected, liked, and perceived as trustworthy by participants than the version that did not use these strategies.

4.1.3 Application to the automotive context

The car is a product with a high emotional value that evokes a wide range of emotions in its users (Sheller, 2004; Steg, 2005). These emotional responses can be attributed to different functions of the car. The car includes instrumental functions by enabling participation in activities and providing comfort through its characteristics, such as

speed, flexibility, and safety. Symbolic functions are fulfilled by the car as a means of self-expression and positioning in the user's social environment. Affective functions are served by associating the car with deeper needs, desires, and emotions experienced while driving (Steg, 2005). The car, therefore, serves different functions in our lives: It fulfils pragmatic needs as a means of transportation and symbolic functions as a means of self-expression through the choice of the car model or other customization options. Furthermore, it evokes memories of journeys or exceptional experiences and can have a stimulating effect through new technologies and the driving experience itself (Grund et al., 2025b; Steg, 2005).

As Bardhi and Eckhardt (2012) showed, car sharing users (unlike car owners) do not have an ownership orientation or identification with the car but instead prioritize utility value. However, Grund et al. (2025b) found emotional attachment to the car also among car sharing users. This attachment is less intense than that of owners. In contrast, car sharing users identify with the concept of sharing rather than owning a car. This identification can increase their attachment to the shared car (Grund et al., 2025b). In conclusion, the duration of use can impact emotional attachment (Fraine et al., 2007) across all user groups. Car owners typically keep their cars for several years (instamotion, n.d.), whereas a leasing contract usually lasts only two to four years (Leschau & Baumgarten, 2024), and their cars are more often new (Autoscout24, 2024). In the context of car sharing, car usage is limited to specific occasions; it is not permanently available.

Grund et al. (2025b) show that the attachment curve between users and their cars becomes more positive over time. However, differences exist between user groups. Owners and lessees begin their attachment in the positive range, while car sharing users start neutral, having no experience with the concept and being unsure of their expectations. For owners and lessees, the pleasant anticipation of the upcoming car is predominant. However, they also experience some uncertainty initially, as they are unfamiliar with the car at this moment (Grund et al., 2025b). The longer the car is used, the greater the trust and the more positive the attachment between the user and the car becomes. Factors such as ease of use, identification, and attachment are considered important in this process. Additionally, the feeling of safety increases as the user becomes more familiar with the car, its features, and functions (Grund et al., 2025b). Attachment to the car can be negatively affected in the short term if defects

or malfunctions occur, as functionality is impaired and the novelty effect wears off (Grund et al., 2025b; Hassenzahl et al., 2015).

Car sharing users are confronted with soiling or damage to the car. In these situations, trust in the car decreases as users feel 'let down'. Once the damage is repaired, the attachment returns to pre-damage levels (Grund et al., 2025b). The farewell to the car is also difficult for many users and can be associated with negative reactions such as grief, both for the car itself and the experiences and memories associated with it (Fraine et al., 2007; Grund et al., 2025b). This grief is particularly pronounced among owners, but also occurs among lessees and car sharing users. At the same time, the pleasant anticipation of the upcoming car can mitigate negative emotions (Grund et al., 2025b).

Four use phases are identified to be important over the lifetime of a car (Grund et al., 2025b):

(1) *familiarization* (received the car a few weeks ago, user has driven the car a few times and has familiarized themselves with some of the functions and features of the car),

(2) *everyday use* (use of the car regularly for some time in everyday life, it is no longer new, no problems with the car),

(3) *defects and malfunctions*; for car sharing users: *dirt and dents* (the car gets unpleasant defects or has minor damages that need to be repaired in a garage; the predecessor left the car dirty), and

(4) *farewell* from the car (decide to hand in the car or total loss; for car sharing users: decide to stop using car sharing or the car is no longer available).

4.1.4 Research questions

As previously described, a car is more than just a means of transport for many users who create an emotional attachment (Sheller, 2004; Steg, 2005). This attachment varies over time due to different factors. Therefore, the first research question considered different use phases:

(1) Which relevant influencing factors and emotions occur in the different use phases (familiarization phase, everyday use, defects and malfunctions/ dirt and dents, and farewell)?

Furthermore, this study aimed to gain ideas on how to support an emotional attachment within different use phases and how an in-car assistant affects the user-

car attachment. So, the second research question relates to the support of an emotional attachment:

(2) How can the emotional attachment to the car be strengthened in the different use phases? What role can in-car digital assistants play in positively influencing this attachment?

As already explained, different user groups should be considered in the context of cars, as each group has specific needs that should be addressed to strengthen the emotional attachment. Therefore, the third research question focused on user groups:

(3) How do the needs of different user groups (owners, lessees, and car sharing users) differ?

4.2 Methods

4.2.1 Research methodology

Three user groups were focused on in the study: (1) owners, (2) lessees, and (3) car sharing users. Four use phases were selected as described: (1) familiarization, (2) everyday use, (3) defects and malfunctions/ dirt and dents, and (4) farewell.

As this was an exploratory and hypothesis-generating study, a qualitative descriptive method was used. For data collection and idea generation, six focus groups (two per user group) were conducted with six participants each, except for one group with five participants (in line with the recommendations of Krueger and Casey, 2009). This allowed a balance between individual contributions and group cohesion. The first focus group of each user group dealt with use phases (1) familiarization and (2) everyday use, the second focus group with use phases (3) defects and malfunctions/ dirt and dents, and (4) farewell.

The focus groups used two different ideation methods: the *6-3-5 method* and the *random stimulus creativity method*. After the first three focus groups (one focus group per user group), only one of the two methods was continued for each use phase, as the number of generated ideas was sufficient, and it was possible to go more into detail instead. Table 22 shows the use phases discussed from the focus group and the applied ideation techniques.

Table 22

Overview of the discussed use phases of the groups and the ideation methods that were used

Use phase	Groups (Gr.)	Ideation method
(1) familiarization	Gr.1 (owner) Gr. 2 (lessees) Gr. 3 (car sharing)	6-3-5 method, Random Stimulus Creativity Technique
(2) everyday use	Gr. 4 (owner) Gr. 5 (lessees) Gr. 6 (car sharing)	6-3-5 method
(3) defects and malfunctions/ dirt and dents	Gr. 1 (owner) Gr. 2 (lessees) Gr. 3 (car sharing)	6-3-5 method, Random Stimulus Creativity Technique
(4) farewell	Gr. 4 (owner) Gr. 5 (lessees) Gr. 6 (car sharing)	Random Stimulus Creativity Technique

The 6-3-5 method was utilized as a structured brainstorming process in which participants independently wrote three ideas on paper. After five minutes, the sheet was passed to the next participant, who could draw inspiration from the ideas provided by others and either develop those ideas or contribute new ones (Wagner, 2022). Once all participants had worked individually on all six sheets, an evaluation phase followed, in which the ideas were briefly presented, and each participant marked particularly strong ideas with sticky dots (Wagner, 2022). This method aimed to generate a substantial number of ideas on how to enhance emotional attachment to the car in general during specific usage phases.

The random stimulus technique was used as an ideation method to encourage participants to think about a topic and develop creative ideas on how the digital assistant can positively influence attachment to the car. This technique consisted of four steps (Wagner, 2022). In the first step, the topic was written on a flipchart for all participants to see, ensuring everyone understood it correctly. Then, random stimulus words were provided (Wagner, 2022). In this study, two words were chosen randomly in advance: 'dog' and 'suitcase' for familiarization and farewell use phases, and 'plant' and 'paper' for defects and malfunctions/ dirt and dents. In the third step, participants analyzed these words by writing down all the characteristics and concepts they

associated with them. Finally, these characteristics and concepts were used as a basis to generate creative and innovative ideas related to the original topic (Wagner, 2022).

4.2.2 Focus group procedure

Each focus group session lasted approximately three hours and was conducted by an experienced moderator from an external agency to avoid bias from the authors' expectations. The moderator was briefed by the authors in advance and provided with a semi-structured guide. The authors observed the discussion from a separate room while taking notes. Additionally, all groups were recorded on video with sound. All focus groups were conducted in German. Each session followed a procedure consisting of four steps:

(1) At the beginning, the participants and the moderator introduced themselves and the moderator encouraged the participants to speak freely and to share their views openly.

(2) Then they continued talking about their car situation (e.g., how many cars do they have and since when). To get into the mood for the topic, the participants were asked about their feelings about their car (or, in the case of car sharing users, about the car they use regularly). It was discussed how these feelings have changed over time and which events have led to these changes.

(3) Afterwards, the first of the two use phases to be discussed was explained. Groups 1 to 3 dealt with familiarization, while groups 4 to 6 focused on everyday use. Each focus group firstly discussed the content of the use phase to gain a basic understanding of the main emotional processes before developing ideas for improvement using the 6-3-5 method. In groups 1 to 3, the random stimulus creativity technique was additionally used in a second ideation round for the same use phase.

(4) The same procedure was followed for the second use phase. Groups 1 to 3 discussed defects and malfunctions/ dirt and dents, and used both ideation methods, while groups 4 to 6 covered the farewell and ideated using the random stimulus creativity technique focused on the digital assistant.

Finally, the participants were thanked for their participation.

4.2.3 Data analysis

For privacy reasons, each participant was given an anonymous label (e.g., 'TN1-23'). Within the label, the first number represented the user group: '1' assigned to owners, '2' to lessees, and '3' to car sharing users. The second number stood for the focus group: '1' is assigned to the first focus group and '2' to the second focus group of each user group. The third number was the participants' number within the group. In this example, it was participant three from the second group of owners.

The video recordings of the six focus group sessions were transcribed verbatim. The transcripts were compared with the observers' notes and then analyzed using the qualitative data analysis software MAXQDA (VERBI Software, 2018). The data analysis followed the recommendations for qualitative content analysis according to Kuckartz (2016). The data were coded and categorized using the deductive-inductive method. In a first step, the category system was developed deductively based on the semi-structured guide, the dimensions of product qualities according to Hassenzahl (2005) and the results of previous studies (Grund et al., 2025b). In a second step, the category system was refined inductively based on relevant text passages: New categories were created and a hierarchical structure of categories was developed. This process was repeated until no further changes in the category system were discernible. A student assistant with experience in qualitative data analysis independently developed a category system. Finally, both category systems were compared. All discrepancies were discussed and a final system was worked out, which was then checked by the second author.

The ideas of the 6-3-5 method were digitized and categorized according to the procedure described above. The number of sticky dots for ideas was also noted. The ideas and statements made using the random stimulus creativity technique were included in the transcripts and analyzed in the group discussion.

4.2.4 Recruiting and participants

The study was conducted between September 6th and 9th, 2022, in an agency's rooms in Munich. The agency was commissioned to recruit and incentivize the participants. The participants were contacted by phone and selected according to specific criteria given by the authors. These screening criteria included: a certain degree of creativity and technical aptitude as well as belonging to a certain user group: (a) car owning and regularly using a private car (at least twice a week) or (b) leasing

and regularly using a car (at least twice a week) or (c) using stationary car sharing with a preference for using a specific model (at least once a month for at least six months). In addition, all participants were required to have an emotional attachment to the car to better empathize with the respective situations emotionally and thus provide more valuable data. For this purpose, quantitative screening questions were used, asking participants to indicate their level of agreement on a four-point Likert scale to various statements such as 'I just love this car' or 'I see the car primarily as a means of transport' (inverted). The screening process and focus groups were originally conducted in German and translated for this publication.

To address ethical concerns, all participants signed a confidentiality agreement. This agreement ensured they would not disclose any information about the study to the outside world. They were also informed before the study that researchers would observe them during the discussion and that the video files would only be used for analysis purposes. The participants' surnames remained unknown to the other participants, the moderator, and the observers. All participants participated voluntarily and were allowed to leave the discussion at any time without any disadvantages. No other ethical concerns were recognized.

An equal number of owners, lessees, and car sharing users was required. A total of 36 participants were recruited, one of whom did not participate at short notice due to illness, resulting in a final sample size of $N = 35$ ($n = 19$ men, $n = 16$ women). The age ranged from 22 to 60 years ($M = 41.92$, $SD = 12.09$).

4.2.5 Quality criteria

The study used established methods of qualitative data collection and analysis and was guided by the Miles and Huberman (1994) quality criteria to ensure the *credibility* of the findings. There was always more than one experienced researcher involved in the planning, implementation and analysis of this study. An external moderator was chosen to lead the focus groups to avoid a guiding effect. The moderator was also experienced in conducting focus groups and applying the ideation methods used. As all participants voluntarily participated in the discussions, it can be assumed that an open and honest basis for discussion was guaranteed. The *dependability* of the study was ensured by a consistent approach to data collection. A guideline ensured that each focus group discussed all relevant issues and a standardized process was guaranteed, without sacrificing individual and situational events and group dynamics.

To ensure *confirmability*, all discussions were recorded and logged. In addition, during the analysis, the researchers regularly exchanged information about the procedure and documented each step. Explicit quotes from participants are used to enhance the comprehensibility of the results. A transparent description of the research design, the data collection, and the analysis provides *transferability*.

4.3 Results

The research questions are answered by presenting the results separately for each use phase and user group. The specific emotional characteristics and ideas generated to increase emotional attachment in the use phases are identified for each user group. Table 23 aligns the ideas that emerged from the respective use phases of different user groups with Hassenzahl's (2005) dimensions. All quotations are translated from German.

Table 23

Ideas mapped to Hassenzahl's dimensions (2005) across use phases and user groups

Use phase	Dimensions of mentioned ideas	Owning	Leasing	Car sharing
(1) familiarization	evocation	X		
	identification	X	X	
	stimulation		X	
	pragmatic	X	X	X
(2) everyday use	evocation	X		
	identification			X
	stimulation	X	X	
	pragmatic	X	X	X
(3) defects and malfunctions/ dirt and dents	evocation			
	identification			
	stimulation			
	pragmatic	X	X	X
(4) farewell	evocation	X	X	
	identification			
	stimulation	X	X	X
	pragmatic			X

4.3.1 Familiarization

Owners reported being initially overwhelmed by all the information about the upcoming car. They needed time to familiarize themselves with it. However, they enjoyed discovering new things and wanted to have their first experiences with it.

> You get in the car, and you feel comfortable and you do not want to get out, I emptied the tank on my first trips because I did not want to get out, I have the sunroof half open, coffee in the car, I drove another lap and another lap, with time driving becomes more and more familiar (TN1-11).

Experiential activities of all kinds strengthened the emotional attachment and created memories. Photo shoots with the car, visits to drive-in cinemas, joint excursions, and conscious enjoyment of driving were suggested. Owners wished to show off their car to support their feeling of pride. Furthermore, they wanted to personalize it to feel more individual. Cleaning and caring for the car served as means of maintaining its value and fostering emotional attachment. They wanted the digital assistant to get to know them and help them personalize the car. “It greets you, recognizes where you want to go, and automatically sets the navigation system for me" (TN1-24). From a pragmatic point of view, owners wanted to learn more about their car and try out new features. Therefore, they mentioned the digital assistant to support them by providing car-specific explanations and feedback on driving behavior.

Lessees, in particular, reported that the smell of the new car was important to them. A long-lasting scent could strengthen the emotional attachment to the car. Like owners, lessees wanted help getting to know and personalizing the car, which they saw as a potential area for digital assistant support. They also valued a unique car pickup and superb service from the dealership (e.g., good accessibility, a personal welcome, and an individual approach to fulfill their needs). Lessees also mentioned positive experiences in a more stimulating context, such as new car events or the opportunity to test the car on a racetrack.

Car sharing users cited various reasons for using car sharing for the first time, with the size of the car being a key selection criterion. They wanted to use the car intuitively and start driving immediately without wasting time getting to know the car. In addition, the car should have technology that is easy to use and to understand. It should be well-equipped and provide a high level of comfort. Monetary benefits, such as free minutes or free test drives, were perceived as encouraging. Car sharing users also

considered quick availability and cleanliness of the car as important. The digital assistant should act as a friend and companion, recognizing the user's individual needs and adjusting the car's settings accordingly. Evocative and stimulating experiences were not considered.

4.3.2 Everyday use

In all user groups, the initial 'infatuation' phase had faded into the everyday phase and a certain routine set in. Owners continued to hope for trouble-free use and began to individualize their cars. Accordingly, they mentioned wanting to personalize their cars just as they regularly redecorate their homes. They wished to adapt the car to their lifestyle and escape the 'daily grind'. For example, owners wanted to keep their cars feeling new for a longer time through regular updates or retrofitting of assistance systems, new varnishing, or seats with reclining or massage functions. Trips in the car were suggested to strengthen the emotional attachment and to create shared experiences. The car itself should make suggestions for specific destinations or activities. At. In addition, owners wanted to share their experiences on internet platforms and exchange ideas with other owners of the same model. Alongside these hedonic aspects, owners also emphasized pragmatic ideas such as easier tire changes, regular checks by the car itself, and cost optimization.

Lessees continued to express satisfaction with their car, although the initial euphoria had worn off because it still feels as good as new. "The infatuation phase wears off a bit after five to six months, like any relationship, it becomes more familiar, at the beginning it is all 'wow cool', then it starts to wear off, but it is still cool" (TN2-22). Compared to owners, cost was a much more important consideration for lessees. They suggested discount promotions (e.g., 'use for twelve months, pay for eleven months') and more flexibility in the duration of lease. Like owners, lessees also wanted changes in appearance, updates, and upgrades, although their suggestions were less intense and frequent. Furthermore, lessees sought experiences that should increase driving enjoyment and positive emotions. However, they mentioned neither ideas to increase evocation nor identification with the car.

Car sharing users described the everyday routine as boring on the one hand, but also as comfortable and safe on the other, as they already knew how to handle the car. Nevertheless, new and unfamiliar cars could provide variety and highlights. To strengthen the emotional attachment during the everyday phase, car sharing users

suggested discount campaigns such as free rides, free minutes, or a free car wash for their car. They also desired more flexible use of the car, for example, when travelling abroad. Like owners and lessees, car sharing users wanted the car to provide suggestions for destinations and events as well as the option to share certain routes or experiences via a social media platform. Furthermore, personalization was important to car sharing users. They wanted the car to recognize them and adapt directly to their needs and preferences. They also suggested welcome rituals like flickering lights or honking to greet them.

4.3.3 Defects and malfunctions/ dirt and dents

Owners reported anger, disappointment, and anxiety when defects or malfunctions occurred. They were uncertain whether the garage would repair the damage cost-effectively and meet their needs. They lacked information about the duration, cost, and nature of the damage.

> I am annoyed, disappointed, I have questions in my head like 'how much will it cost', 'how long will it have to stay in the garage', do you research garages first or is it possible to do it yourself? What tools or spare parts will I need? (TN1-11)

Quick assistance services, such as showing the nearest garage with user ratings from the car itself, as well as comprehensive information on repairs and damages were considered particularly desirable by owners. Concerns about costs could also be alleviated by reassurance that only necessary repairs will be carried out and that the costs will be covered by, for example, the insurance company or the seller. Discounts offered by garages, such as a free car wash after an appointment or the installation of a free special feature, were seen as attractive. In general, this phase should be made as pleasant as possible by minimizing inconvenience and maintaining mobility by providing a replacement car. Calming and distracting the owners would be helpful and could be achieved by various means, such as reminding them of rational reasons ('The main thing is that no one is hurt', 'It is just a car'). The digital assistant could support by providing the desired information, e.g., explaining the damage, organizing help, and playing relaxing music.

Lessees expressed ambivalent feelings about technical problems. On the one hand, they felt annoyed, but on the other hand, they put the damage into perspective and may already be interested in a new car. One participant commented: “The car is

a commodity, I do not mind the garage, maybe I will start looking for new cars again" (TN2-14), while another participant said:

> I am angry because someone drove into my car and I had to pay for it myself, the car should look well-maintained as a status symbol, it is expensive, I do not want to drive around in it like a dirty car, and if you have dents in it, that annoys me. (TN2-16)

Like owners, lessees wanted fast and competent help. They proposed a digital garage via video call or the car itself diagnosing the fault, checking the availability of spare parts in garages, making appointments, and explaining the next steps to the user (e.g., in the event of an accident). The digital assistant could also perform these tasks, providing reassurance and safety. Lessees were also concerned about costs and suggested a flat rate for repairs or a combined insurance and lease payment to avoid additional costs. Like owners, they wanted this phase to be as pleasant as possible so they also suggested that a replacement car of at least the same value should be provided. They also wanted coffee and snacks available in the garage area or even an all-inclusive, worry-free package.

Car sharing users were concerned that they might be charged for damage to the car. Therefore, they checked whether any dents or other damage had already been reported before starting their journey. Car sharing users were particularly interested in the pragmatic aspects, such as reminders to check the car for dirt and damage before use. The digital assistant could enhance safety by displaying dirt and damage before the journey and clarifying that this is not the user's fault. They also suggested that the car itself should detect defects and collisions and identify the person in charge. If the car was dirty, they reacted with anger and disappointment but emphasized that this was not the car's fault but rather that of the previous user or even the fleet provider. Consequently, they supported stricter rules, such as requiring photos of the car's condition at the journey's end. Eating and drinking in the car should be restricted, and the user should be informed if the previous user had animals with them, especially if the user is allergic to animal hair. Repeated soiling should be penalized. To react quickly in the event of soiling, car sharing users wanted cleaning products in the car and discounts or compensation offers. Additionally, they wanted the digital assistant to provide them with clear instructions in the event of an accident.

4.3.4 Farewell from the car

For owners, the farewell to the car and then purchasing a new one was an emotionally stressful phase. They emphasized the difference between selling a car, which involves some planning and the intention to buy a better car, and an accident, which is unexpected and abrupt. Even if they felt some pleasant anticipation about the upcoming car, albeit with some uncertainty about making the right decision, negative feelings predominated, including sadness, frustration, anger, and the pain of separation. They were saddened by the thought that the memories associated with the car would be lost.

> Unless you buy exactly the same model again, it might be not so bad, but there are still memories attached to it, but if I say I'm going to get rid of it now and buy the i3, I love it too, but then the question is will I get on with it, is it good enough for me? (T1-24)

Accordingly, owners wanted the digital assistant to act as the car's 'brain', storing all the memories and settings and transferring them to the upcoming car. This would make it easier to say goodbye, as only the car's chassis would change, whereas the memories and personal preferences would remain.

> It is not so hard to say goodbye, it takes everything - including the memories, it knows what my favorite music is, it has got all my memories, it knows my memories, whatever they are, I am taking it with me, that makes it extremely easy for me, I am basically taking the head of the whole thing and just leaving the shell there and the shell gets a new look and the old tried and tested gets a new look. (...) The (digital assistant) of the future has remembered things about you, it knows your favorite routes, your favorite restaurant, (...) it has driven with you all your life and it goes with your memories into the next car where more memories will take place. (TN1-21)

Owners also hoped the digital assistant would help to build pleasant anticipation for the upcoming car. For example, it could explain new features, provide regular delivery status updates, and automatically adjust all settings in the upcoming car. However, concerns were also expressed about the feasibility of these features when switching brands.

Lessees also said that a sudden and unforeseen farewell from the car would be much more emotionally stressful than a planned change. They found it sad to say

goodbye to a leased car, but not as sad as to a car they owned. The pleasant anticipation of the upcoming car generally outweighed the negative feelings. It was important to lessees that the upcoming car felt like an improvement on the previous model.

> It used to be worse when I owned a car, you didn't know what was coming next, now the anticipation of the next car is greater than the pain of separation, and it makes a difference whether it's a sudden death or whether I can adapt to it. (TN2-22).

Lessees also wanted a digital assistant to save all settings and memories and transfer them to the upcoming car. One participant commented: "Imagine you could take your assistant from your previous car, let us call him Joe, to your new car and he would know all the settings" (TN2-22). However, they were critical of the technical implementation of the data transfer, especially when changing car brands. They also questioned whether they would feel emotionally attached to the car itself or to the digital assistant. Nevertheless, they saw great potential for the digital assistant, especially among the younger generation, who grew up with digital technology and would use it more.

Car sharing users exhibited a wide range of feelings when thinking about the farewell to a car sharing car. While one said: "It is not mine, you borrow it, it would not be so bad, I will just take another one" (TN3-23), another one stated: "I will start crying straight away" (TN3-21). This affected the intention to use car sharing further. Some users would use car sharing less frequently after such a farewell, while others would pragmatically continue to use another car. However, car sharing users emphasized the difference in the farewell to their own car. Car ownership is associated with much more emotion, memories, and investment. In addition, car sharing users assumed that if a particular model was discontinued, the fleet provider would offer a better replacement model to maintain customer loyalty. They wanted the digital assistant to give them advance warning of an impending car discontinuation, e.g., "We would like to inform you that the car will be discontinued in three weeks" (TN3-23). They would be happy to receive free minutes or kilometers as a parting gift. At the same time, the digital assistant should build pleasant anticipation for the next, better car by advertising it and offering free minutes. The idea of a digital assistant that saves the user's settings and automatically adapts them to the upcoming car was also mentioned. However, unlike owners and lessees, memory storage was not explicitly mentioned.

4.4 Conclusion

4.4.1 Discussion of main results

This study aimed to identify factors that strengthen the emotional attachment between users and cars. Through focus groups, different user groups: owners, lessees, car sharing users were analyzed, examining the important use phases throughout the entire period of use: familiarization, defects and malfunctions/ dirt and dents, everyday use, and farewell. The results of the present study support previous research on hedonic and pragmatic product attributes that influence emotional attachment (Hassenzahl, 2005; Mugge, 2007) and extend existing knowledge to the automotive context. Furthermore, concrete approaches are provided to prevent a loss of attractiveness over time. In addition, including different user groups allows for a more nuanced view of the results.

It is shown that the relevant product qualities for increasing emotional attachment vary across different use phases. This aligns with the findings of Wilamowitz-Moellendorff et al. (2007), who observed a change in the perception of product qualities over time. Hassenzahl (2005) noted that the initial stimulation of product novelty diminishes over time, leading to boredom while conveying a sense of security. This study confirms this observation: in all user groups, pragmatic aspects are relevant initially to help them familiarize themselves with the car. Additionally, suggestions are made to enhance identification, particularly focusing on personalizing the car. While owners aim to create an emotional attachment through evocation (e.g., shared experiences), lessees are more interested in additional stimulation (e.g., special pickup).

After the novelty effect has worn off in everyday use owners also express ideas about how to increase stimulation to maintain the car's novelty. At the same time, they continue to seek shared experiences with the car to strengthen the emotional attachment. This is consistent with the findings of Karapanos (2013) and Mugge et al. (2005), who demonstrated that emotional attachments develop over time through positive interactions and memories. Conversely, lessees continue to favor stimulating and pragmatic aspects, but also attach importance to convenient, flexible use and cost efficiency. This aspect is also considered important by car sharing users, while evocation and stimulation are less relevant for them. Although Bardhi and Eckhardt (2012) found evidence that car sharing users do not show an ownership orientation or

identification with the car, this study indicates that strengthening identification, especially through personalization, can support the emotional attachment to the car both initially and in everyday use.

This study shows that defects and malfunctions, as well as dirt, lead to predominantly negative emotions, which aligns with the findings of Fraine et al. (2007) and Grund et al. (2025b). This applies to a lesser extent for lessees and car sharing users than for owners (Grund et al., 2025a; Grund et al., 2025b). As the car's functionality is limited during defects and malfunctions, it is not surprising that pragmatic ideas are mentioned, such as providing a replacement car or the fastest and most cost-effective repair possible. Car sharing users also express concern that any damage could be at their expense.

For the farewell, all groups emphasize the difference between a planned car change and an unexpected accident, with the latter being seen as significantly more emotionally distressing, which aligns with Grund et al. (2025b). All groups mention the idea of a digital assistant that can be transferred from car to car, storing memories, personal preferences, and settings, effectively serving as the 'brain' of the car. In the upcoming car, it can expedite personalization and identification while ensuring that memories from the previous car are not lost. Furthermore, the participants express a desire to actively foster pleasant anticipation for the upcoming car in advance.

Modern technologies, such as in-car digital assistants, hold great potential to strengthen the emotional attachment between users and their cars by enabling personalization, anticipating user needs, and providing information and support across various use phases. Additionally, digital assistants can serve as memory storage and simplify the transfer of personal preferences to upcoming cars. They can also foster pleasant anticipation for new car features and functions. Although the findings on digital assistants align with those of Duggan (2016), who suggested that a digital assistant focusing on attachment alongside its functional benefits is more highly valued by users, our findings extend this perspective by reflecting a desire for the digital assistant to become the 'brain' of the car. However, it is crucial to acknowledge that there are also limitations to using digital assistants in cars: for instance, privacy concerns regarding the transfer of user data and technical incompatibilities between different car brands may hinder the adoption and advantages of this technology.

4.4.2 Limitations and future research

The study uses a qualitative data approach, which is inherently prone to bias and social desirability. Furthermore, the study sample is relatively small and consists exclusively of participants who already had an emotional attachment to their car. Although this limitation is necessary for the participants to better empathize with the respective situations emotionally and thus provide more valuable ideas, it restricts the generalizability of the results. Additionally, the study was conducted in Germany, and emotional attachment to the car may vary across different cultures due to differing values, car usage patterns, and social norms. Therefore, future research should consider cultural factors to gain a more comprehensive understanding of emotional attachment to cars.

This study opens new perspectives by incorporating digital assistants to enhance product loyalty. In this context, a comprehensive investigation of the influence and long-term effects of these digital assistants on the emotional attachment between users and products is necessary. It is crucial to clarify whether digital assistants can serve as mediators or moderators of emotional product attachments. Additionally, the concepts generated in this study should be assessed to determine if they can influence emotional attachment during the various use phases. Nevertheless, this study contributes to understanding the emotional attachment between users and their cars. This knowledge can provide a foundation for design, marketing, and strategic decisions aimed at enhancing user satisfaction, promoting sustainable transport, and fostering positive attachments between users and their cars throughout their period of use.

5. Conceptualization of a Mid-Fidelity Prototype

Chapters 2 and 4 revealed strong emotions when users change cars. The process, which involves the farewell to the previous car and looking forward to the new one, elicits intense emotional responses. On the one hand, users may feel sadness as they part with their previous car. On the other hand, they may anticipate the upcoming car with excitement, though they simultaneously feel some uncertainty about whether the car will truly meet their expectations.

To meet the contrastive emotions while car change two prototype variants of mobile phone applications were developed to support users during a car change emotionally. The prior studies indicated that preserving memories of the previous car could be beneficial (corresponding to the determinant memories). Furthermore, stimulating anticipation for the new car was identified as helpful (corresponding to the determinant pleasure). Consequently, one prototype variant focused on ideas belonging to memories and the other one included ideas to generate pleasure. To create these prototypes, firstly, additional ideas were generated in ideation workshops, supplementing the former findings. Subsequently, these ideas were reviewed and reduced for redundancy, technical feasibility, and clear alignment with memories and pleasure. Finally, each idea's potential to enhance user satisfaction was assessed. These three working steps will be discussed in detail below.

5.1 Generating further ideas

Two online ideation workshops were conducted, each with six employees from CARIAD (N = 12) to complement the ideas gathered from the focus groups in Chapter 4. The participants were professionals in diverse fields, including UX researchers, data specialists, and artificial intelligence (AI) developers. The ideation workshops with experts from the automotive industry should ensure a more comprehensive exploration of potential approaches. Miro (2022), as a collaborative whiteboard, was used as the workspace and for visualization purposes. Each workshop lasted approximately 120 minutes and was conducted remotely.

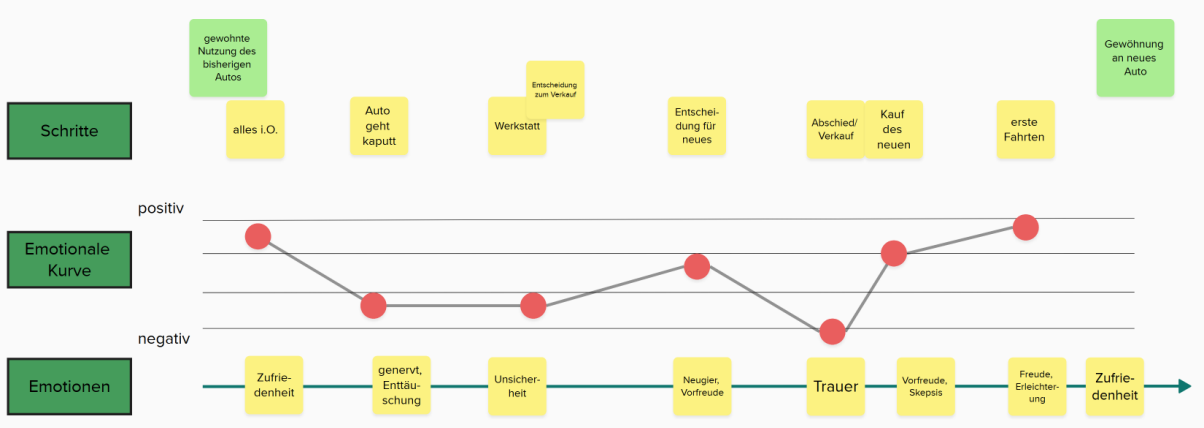
The workshops began with a discussion about participants' own experiences with emotions towards cars, especially during car changes, to deepen their engagement in the topic. Subsequently, a mood board containing images, texts, and statements from

people expressing their emotions during car changes was shown to intensify the focus on emotional aspects. Participants were asked to empathize with these people.

Subsequently, participants were divided into two separate groups of three persons each to create a user journey. The mapping of a user journey is a creative method in the field of UX to understand relevant user processes (Endmann & Keßner, 2016). One group focused on a predictable change, such as purchasing a new car, while the other group investigated an unpredictable change, such as a sudden total loss of the car. Participants were asked to note relevant steps from 'familiar use of the previous car' to 'getting used to the new car'. Additionally, they draw a curve in a coordinate system on the whiteboard to express their emotional valence (negative to positive) during these steps and note relevant emotions. Time was represented along the x-axis, and emotional valence was represented on the y-axis (Figure 10). Subsequently, the actual ideation phase began in the form of brainstorming in small groups. Ideas to make the car change emotionally easier were to be written down. Afterwards, the two groups presented their ideas to each other and discussed them. Finally, the participants were thanked for their participation.

Figure 10

Example of the user journey for a predictable change, including relevant steps, the emotional valence, and relevant emotions



The ideas collected from the focus groups (Chapter 4) and both ideation workshops were checked for redundancies and technical feasibility. Experts from the relevant fields thoroughly examined whether the data required to realize the idea was available. Ideas that seemed redundant or technically not feasible were removed from the further process. The following 18 ideas remained:

- *Postcards:* personalized postcards that the user continues to receive after parting with the car, get information about the old car: what happened to it?
- *Travel parameters:* display of travel parameters for each journey undertaken (e.g., kilometers, places, countries),
- *Photo album:* a digital photo album is created and can be edited,
- *Regular reminders:* push-up notifications presenting selected photos or experiences like "Today X years ago" (cf. Google Photos),
- *Records:* an overview of records achieved with the car (e.g., most driven kilometers),
- *Real-time tracking:* real-time tracking to monitor the status of the upcoming car's manufacturing or delivery process,
- *Live image:* live images or videos of the car's production are displayed,
- *Explanation of new functions:* new features or improvements of the upcoming car are displayed and explained in advance,
- *Video clips:* short video clips about the upcoming car,
- *Gaming:* use virtual car models of the upcoming car in gaming,
- *3D-Model:* display of a personal 3D model of the respective car from the interior and the exterior,
- *NFT:* create a Non-Fungible Token (NFT) of the car,
- *Community:* share events with others who use the same car model or brand
- *Badges:* Achieving badges (cf. Duolingo), e.g., first night travel, fuel-efficient travel,
- *Family and Friends:* share events with family and friends,
- *Ranking:* rank past cars (favorite car at position 1),
- *Toy car:* have a toy car of your vehicle made,
- *Merchandise:* shop for purchasing car merchandise.

5.2 Alignment with 'memories' and 'pleasure'

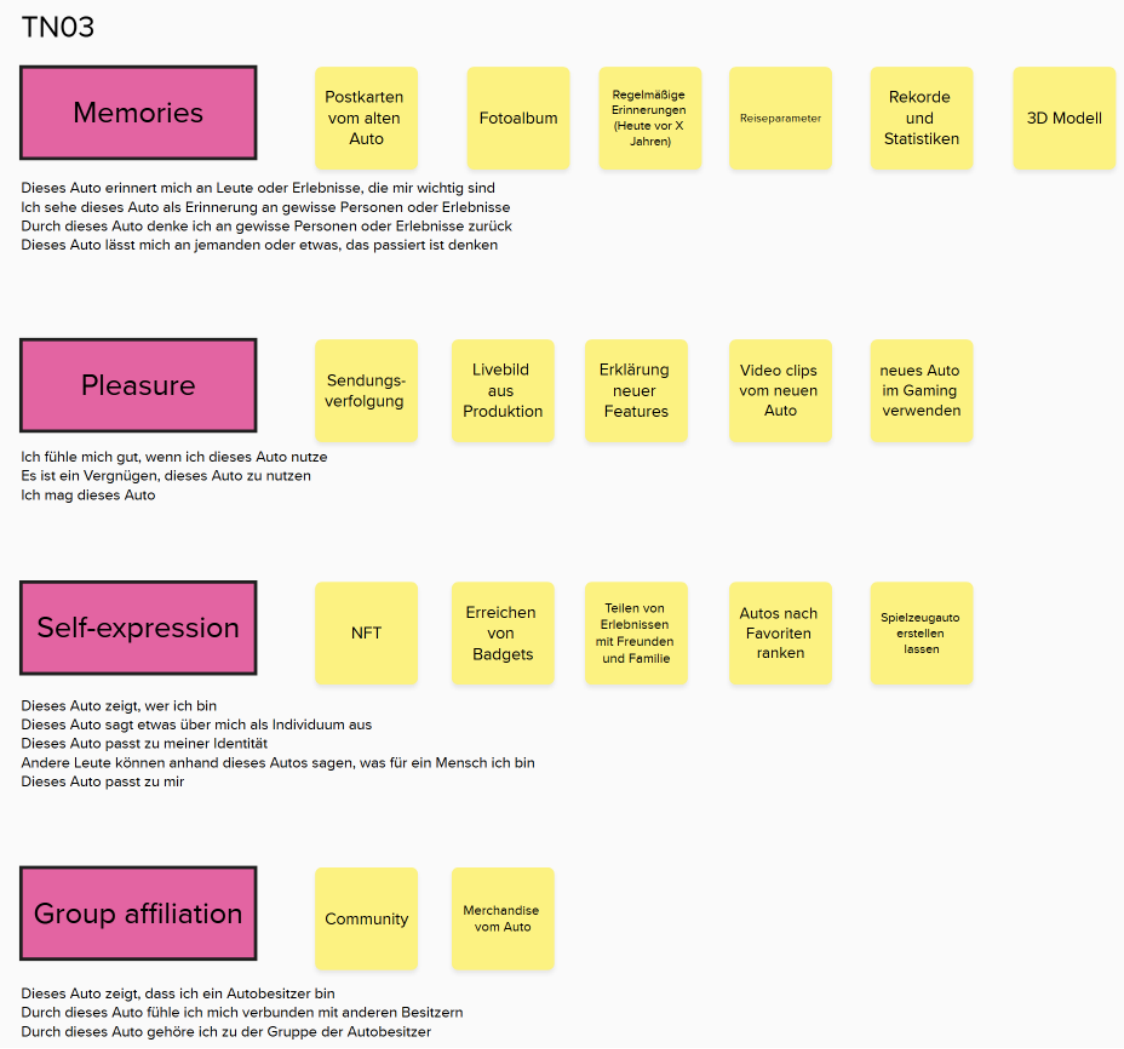
The remaining ideas aiming to improve the car change emotionally were assigned to the determinants memories and pleasure as input to develop two distinct prototype variants. To achieve this, card sorting sessions were conducted with $N = 11$ additional employees from CARIAD who had not participated in the ideation workshops before.

These employees were also from diverse professional backgrounds, again including UX researchers, data specialists, and AI developers.

Again, a Miro board was used for the card sorting. Each idea was written on a separate digital card. In addition, the determinants of product attachment - memories, pleasure, self-expression, and group affiliation – were listed as overarching categories. After the determinants were briefly explained, the participants were asked to assign the idea cards to the respective categories. Figure 11 illustrates the assignment of the ideas to the determinants of one participant.

Figure 11

Assignment of the ideas aiming to support during the car change to the determinants of product attachment according to Mugge (2007)



Note. In pink are the determinants and in yellow are the ideas that were assigned to these determinants by the participant

Next, we counted the total number of times each idea was sorted to its assigned determinant across all participants. Ideas that were clearly associated with either memories or pleasure by at least eight participants were further considered. Table 24 shows the number of assignments of each idea to the respective determinants across all participants.

Table 24

Frequency of idea assignment to product attachment determinants in card sorting across all participants (N = 11)

Idea	Determinants of product attachment				Decision
	MEM	PL	SE	GA	
Postcards	11	0	0	0	included
Travel parameters	11	0	0	0	included
Photo album	11	0	0	0	included
Regular reminders	10	1	0	0	included
Records	8	0	3	0	included
Real-time tracking	0	11	0	0	included
Live image	0	11	0	0	included
Explanation of new functions	0	9	1	1	included
Video clips	0	9	0	2	included
Gaming	0	8	2	1	included
3D-Model	3	4	4	0	included
NFT	1	1	9	0	excluded
Community	0	0	0	11	excluded
Badges	2	2	7	0	excluded
Family and Friends	3	0	7	1	excluded
Ranking	6	1	3	1	excluded
Toy car	3	4	4	0	excluded
Merchandise	2	1	4	4	excluded

Note. MEM = Memories, SE = Self-expression, GA = Group affiliation, PL = Pleasure; Consequence: If the idea was assigned to the determinant memories or pleasure at least eight times, the idea was included in further considerations

As a result of the car sorting sessions, ten ideas were attributed to the determinants memories and pleasure. Five Ideas addressed memories:

- personalized postcards that the user continues to receive after parting with the car,
- the display of travel parameters for each journey undertaken,
- a digital photo album of the car,
- regular push notifications presenting selected photos or experiences, and
- an overview of records achieved with the car.

Five ideas addressed pleasure:

- real-time tracking to monitor the status of the upcoming car's manufacturing or delivery process,
- live images from the production,
- explanations of new features in advance,
- short video clips, and
- drive the upcoming car in video games.

All other ideas (3D models, NFT, community, badges, family and friends, ranking, toy car, and merchandise) could not be associated with either memories or pleasure. They were therefore not considered further. An exception was made for 3D models, which could not be assigned to any determinant of product attachment. Therefore, 3D models were chosen as the basis and overview page for both variants to ensure a comparable structure. In total, eleven ideas (five ideas addressing memories, five ideas stimulating pleasure, and the 3D model) were considered further.

5.3 Potential to enhance user satisfaction

The initial concept of displaying driving parameters evolved into two separate features:

- a heatmap of driving patterns visualizing the user's frequency of presence at various locations through color coding and
- detailed driving parameters for individual journeys

Furthermore, the 3D model concept of the car was further subdivided into separate exterior and interior views. Therefore, 13 ideas should be evaluated regarding their appeal to users by using the Kano Model (Kano et al., 1984).

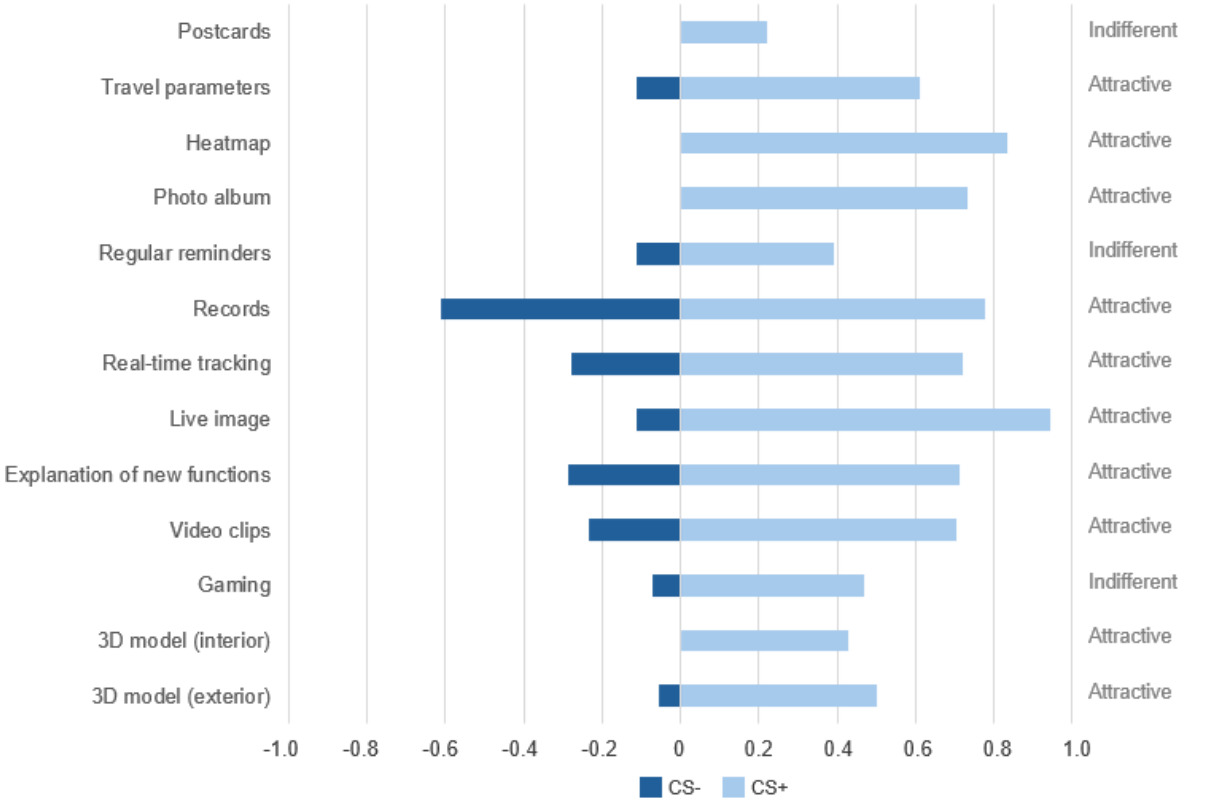
The Kano Model is a framework for understanding how meeting user needs impacts user satisfaction. Product developers can systematically identify and evaluate user

needs and expectations by employing this model throughout the development process. Each idea is assessed through functional (How would you feel if [idea] is present?) and dysfunctional (How would you feel if [idea] is absent?) questions. For each question, the participant chose one of the following answering options: 'I like it', 'I expect it', 'I am neutral', 'I can tolerate it', and 'I dislike it'. The answering pattern allows categorizing the ideas based on their importance and potential to influence user satisfaction by classifying them into must-be, one-dimensional, attractive, indifferent, and reverse (Kano et al., 1984). An idea was rated as attractive by a participant if their response to the dysfunctional question was 'I expect it', 'I am neutral', or 'I can tolerate it', and their response to the functional question was 'I like it'. Subsequently, the collected data from all participants were aggregated to identify an overall trend. The final classification of an idea was determined by the majority preference within the aggregated data. Satisfaction coefficients (CS+/-) can be derived from the frequency distribution of how often an idea was assigned to a particular classification. CS- describes dissatisfaction when the idea is absent, whereas CS+ describes the potential to generate user satisfaction when the idea is present.

Questionnaires, designed using the Kano model, were sent to N = 20 CARIAD employees who had not participated in the ideation workshops or the card sorting activity. Of these, 19 completed the questionnaires. The ideas were described in written form using concise texts, followed by the functional and dysfunctional questions. The whole questionnaire can be found in Appendix C. Figure 12 shows the satisfaction coefficients and the classification of the ideas.

Figure 12

Satisfaction coefficients CS- and CS+ for the ideas and their assignment to product features according to Kano's model (1984)



Note. CS- indicates the level of user dissatisfaction when the feature is absent, whereas CS+ represents the potential of the idea to generate user satisfaction when the feature is present. The value range for C- is between -1 and 0, for C+ it is between 0 and +1.

Ten ideas were classified as 'attractive': the travel parameters, including a heatmap, the photo album, displaying records, real-time tracking of the upcoming car, including a live image of production, the explanations of new functions, video clips, and the 3D models of the interior and exterior. Receiving postcards from the car, regular reminders, and the gaming option were rated as indifferent. Therefore, they cannot create satisfaction, but neither do they lead to dissatisfaction when the ideas are absent. Therefore, these ideas were not further considered.

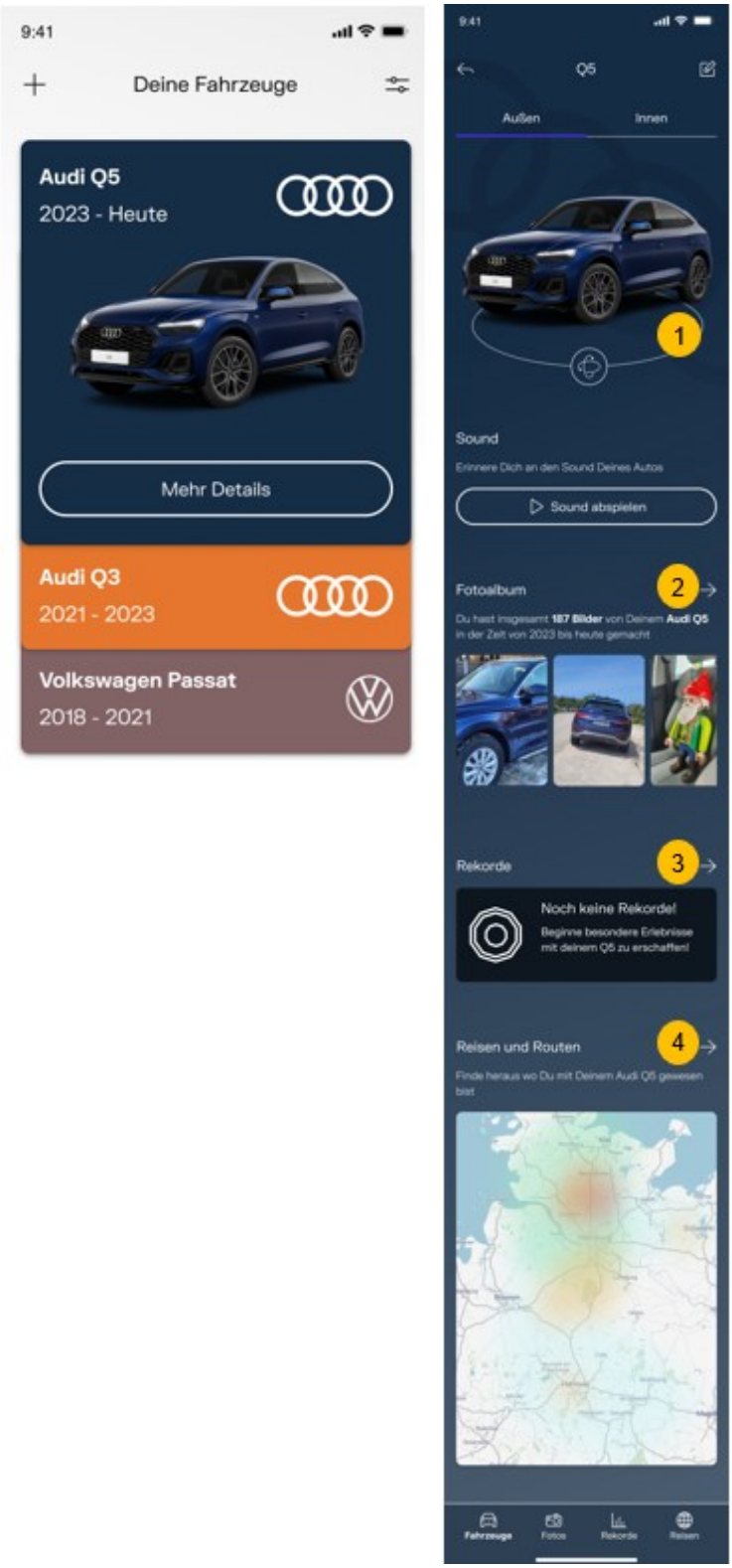
5.4 Concept development

The next step was to transform the ideas classified as 'attractive' in the Kano Model into features and develop a concept. For strategic and economic reasons, it was decided to implement the concept as an app rather than through a digital assistant as discussed in Chapter 4. This ensures compatibility with older car models, simplifies the integration of photos, and allows users to access the content at any time. I developed the concept with the final features and created both prototype variants ('Memories' and 'Pleasure') using Figma (2023). These prototypes already included the click flow. A designer was involved in adapting the prototypes to CARIAD's corporate design. For confidentiality reasons, the prototype design presented in this dissertation was slightly altered. The whole prototype is shown in Appendix D.

The 'Memories' variant and the 'Pleasure' variant exhibited a comparable structure. On the start page of the 'Memories' variant, tiles of past and current cars were presented (Figure 13, left). Each of the displayed tiles offered the possibility to see the respective car. Users could access detailed information from there, leading to a specific overview page of the selected car (Figure 13, right). This page visualized the integrated functions, which invited further exploration. In the upper section of the page, an interactive 3D model of the car (1) was shown, which allowed a comprehensive view of the exterior and interior from all perspectives. Below, links to a photo album (2) and to a display of the records achieved with the car (3) were integrated. Furthermore, an excerpt of the heat map (4) was directly accessible, from which detailed information about past journeys and their parameters could be retrieved.

Figure 13

Start page for the 'Memories' variant (left), overview page of the current car (right)



Note. (1) is the 3D model of the respective car, (2) links to the photo album, (3) navigates to the records, (4) shows an excerpt of the heatmap and links to further travel details

A similar structure was used for the 'Pleasure' variant. The start page was expanded by including the future car (Figure 14, left). By clicking on further details, the overview page of the upcoming car appeared (Figure 14, right). Here again, on top, the 3D model of the respective car was displayed (5). Below were functions for real-time tracking and live images (6). Additionally, the option was offered to retrieve video clips (7) and to view explanations of new car functions (8).

Figure 14

Start page of the upcoming car in the 'Pleasure' variant (left), overview page (right)

Note. (5) is the 3D model of the respective car, (6) opens the real-time tracking and live image, (7) directs to more video clips, and (8) provides explanations of new features in the car

6. Enhancing the Car Change Emotionally: Insights from a Mixed Method Approach

Author	Author position	Scientific ideas %	Data generation %	Analysis & interpretation %	Paper writing %
Mareike Grund	1	90	100*	90	90
Ingo Totzke	2	10	0	5	5
Arnd Engeln	3	0	0	5	5
Title of paper:		Enhancing the Car Change Emotionally: Insights from a Mixed Method Approach			
Status in publication process:		accepted			

* I created the concept for the prototype and independently implemented it as a low-fidelity prototype. An experienced designer visually adapted this concept to the design specifications of CARIAD SE. SAGO Germany HQ recruited participants, and I conducted the study.

Abstract

Emotional product attachment comprises multiple determinants. The significance of these determinants can change over time. Cars can evoke a wide range of emotions, particularly during a car change. This may be characterized by sadness over the loss of the previous car and the associated memories, as well as a pleasant anticipation or uncertainty regarding the upcoming car. Apps may help to overcome such an emotional dilemma. The study reported here investigates the impact of prototypical app variants on the emotional perception of car change. The app variants were explicitly designed to address memories and pleasure. A mixed-methods approach, combining qualitative questions and quantitative measurements, was employed. Our sample consisted of $N = 43$ participants with varying levels of emotional attachment to their car. The results indicate that the app variants reached their intended goals. The variant focusing on memories could store memories of the car, leading to both facilitating and hindering the emotional handling of the car change. The app focusing on pleasure could stimulate anticipation for the upcoming car, proving to be the most effective strategy to support positive feelings during car change. Notably, the perceived helpfulness of the app variants was independent of the user's level of emotional attachment.

This study demonstrates that digital interventions can influence emotional attachment to cars, providing new insights into the complex relationship between users and their

possessions. The findings give implications for designing user experiences that aim to enhance emotional attachment and long-term use of products like cars.

6.1 Introduction

6.1.1 Emotional product attachment

People can develop attachments with brands or objects as they do with other people (Page, 2014; Park et al., 2010). These attachments emerge from ongoing interactions between users and specific products. They influence consumer decisions, including continued product use intention, purchasing behavior, and brand loyalty (Diefenbach & Hassenzahl, 2017; Fournier, 1998; Park & Macinnis, 2006). Emotions, amongst others, consist of two components: valence and arousal. While valence reflects the direction of the emotional response (negative or positive), arousal indicates the intensity of the emotion (calming or exciting) (Bhandari et al., 2017; Deng & Poole, 2010; Kensinger, 2004).

Hassenzahl (2005) distinguishes between hedonic and pragmatic product qualities. Both influence product evaluation and attachment. Pragmatic qualities such as usability and utility directly support task completion. Hedonic qualities consider intensified emotional user experiences. Hedonic qualities encompass: (1) *stimulation*, evoking emotional responses through novelty and excitement; (2) *evocation*, triggering personal memories and emotions; and (3) *identification*, allowing users to express their identity through the product (Hassenzahl, 2005). Winder (2006) found a strong correlation between the prominence of hedonic qualities and the depth of emotional attachment formed with a product. Both product qualities contribute to an overall judgment regarding the appeal of a product, leading to an assessment (e.g., good or bad). This can result in behavioral consequences (e.g., increased usage frequency) and emotional outcomes (e.g., joy, satisfaction) (Sandweg et al., 2000). For example, Wang and Wang (2023) demonstrated hedonic and pragmatic quality perceptions mediate the impact of emotional arousal and valence on smartwatch usage intention. They concluded that product developers should not only fulfil emotional needs but also consider the hedonic experience alongside pragmatic issues.

Mugge's (2007) model on emotional product attachment aligns partly with Hassenzahl's (2005) framework for hedonic product qualities. According to Mugge (2007), four key determinants foster emotional attachment between users and

products. (1) *Self-expression* pertains to users' desire to distinguish themselves from others and convey their identity through a product. This partially aligns with Hassenzahl's (2005) concept of identification. (2) *Memories* describe the product's capability to evoke positive memories and emotions in the user, paralleling Hassenzahl's (2005) evocation dimension. (3) *Pleasure* refers to the immediate enjoyment and positive feelings experienced by a user when interacting with a product. Although not explicitly mentioned in Hassenzahl's (2005) model, stimulation can be seen as an aspect of it. (4) *Group affiliation* describes the user's need to feel connected to a social group and gain recognition and acceptance through the product. This determinant is not directly represented in Hassenzahl's (2005) model but can be interpreted as an aspect of the identification concept.

6.1.2 Importance of time for emotional product attachments

The perceptions of the product qualities evolve over time. Hedonic qualities tend to fluctuate more than the relatively stable pragmatic qualities (Wilamowitz-Moellendorff et al., 2007). According to Kujala et al. (2011), the most significant shift in a product's attractiveness occurs during its initial stages of use. This observation aligns with Pettersson's (2016) findings, highlighting that the first impression is crucial for shaping long-term product loyalty. At the beginning of using a product or even before its purchase, users experience a phase of anticipation during which expectations about the product are formed. The novelty of a product generates curiosity and excitement about exploring its new features, which stimulates and elicits pleasure in the user (Hassenzahl, 2005). However, over time, this stimulation diminishes as the user becomes used to the product unless it is continually stimulated by other methods, such as regular updates. Habituation can lead to a decline in the attractiveness of a product (Hassenzahl, 2006). Conversely, attractiveness perception can also grow as a product becomes more familiar and better understood (Hassenzahl, 2006). Over time, memories and a stronger identification with the product accumulate (Karapanos, 2013). Through repeated interactions, positive associations and evoked memories, lasting positive feelings towards a product develop over time (Norman, 2005). Positive memories are important for fostering product loyalty (Mugge et al., 2005). Given the positive correlation between product-related memories and the degree of attachment to a product, it is reasonable to infer an increase in product loyalty over time (Mugge et al., 2005).

According to Hassenzahl and Monk (2010), products - particularly technologies and their functionalities - gain significance only through users' experiences with them. They consequently propose to "put experience before the product" (Hassenzahl & Monk, 2010, p. 63). This experience-oriented approach emphasizes individual and personal interactions, thereby creating a narrative with the product that generates emotions and meanings, which then become integral aspects of the product itself (Hassenzahl, 2001).

6.1.3 Application to the automotive context

The car is a product that commonly elicits emotions and is used over extended periods (Sheller, 2004; Steg, 2005). Beyond its functional role as a mode of transportation, the car serves as a means of self-expression and personal identity for many individuals. This is evident in the car model and customization options, which allow users to convey their personality and values. Furthermore, cars are often tied to memories of significant life events and experiences. Using a car can evoke excitement and pleasure, particularly when integrating modern technologies and the thrill of driving (Grund et al., 2025b; Steg, 2005). The attachment between users and their cars strengthens over time. Initially, users feel anticipation and uncertainty, which become trust and affection over time as they become more familiar with their cars (Grund et al., 2025b). Special memories and experiences associated with the car are the primary reason for building an emotional attachment (Grund et al., 2025b). A survey in the United States corroborates this emotional attachment: 64% of participants consider their car as a friend, and a third would even prefer to take a scratch themselves than see their car get one (SWNSDigital, 2019).

Farewell from a car can be a challenging experience for many users. It is often accompanied by negative emotions such as grief and loss, both for the car itself and the memories and experiences it represents (Fraine et al., 2007; Grund et al., 2025b). The US survey found that over 10% would rather break up with their partner than part with their car. Nearly half of the participants admit to shedding tears when saying goodbye to their car. Moreover, over half of the participants still regret giving up a car they loved, as they associate so many deep memories with it (SWNSDigital, 2019).

Grund et al. (2024) researched how to emotionally support users with emotional attachment to their cars during the farewell to the car: Users desired a memory

repository allowing them to preserve their memories associated with the car when parting with it. They described it as the 'brain' of the car that could be taken with them, providing a sense of continuity. Therefore, our first research question is: Can storing memories and experiences with the previous car help users emotionally during the car change?

Furthermore, generating pleasant anticipation for the upcoming car would help alleviate negative emotions during the car change (Grund et al., 2024). Users desired to get familiar with the upcoming car and create new memories and experiences that would stimulate positive emotions. Therefore, our second research question is: Can stimulating anticipation for the upcoming car help users emotionally during the car change?

As changing cars is an emotional process, it offers potential for intervention. This study aims to implement and validate approaches to support users who struggle to part with their cars emotionally. To address the user's desire for a portable memory of car-related experiences, we operationalized the ideas developed by Grund et al. (2024) through a mobile application. This approach avoids physical modifications to the car to influence emotional attachment. To address the research questions, three different variants of an app prototype were developed:

1. 'Memories' aimed to store memories of the previous car ('Evocation' according to Hassenzahl, 2005, and 'Memories' according to Mugge, 2007),
2. 'Pleasure' aimed at stimulating anticipation of the upcoming car ('Stimulation' according to Hassenzahl, 2005) and 'Pleasure' according to Mugge, 2007), and
3. 'Pragmatic' without emotional functions was integrated into the evaluation tests as a baseline.

To answer the first research question, we postulated the following hypotheses:

H1: 'Memories' will better preserve memories with the previous car than 'Pleasure' and 'Pragmatic'.

H2: The overall car change is perceived more positively with 'Memories' than with 'Pragmatic'.

H3: The farewell of the previous car is perceived less negatively with 'Memories' than with 'Pragmatic'.

To answer the second research question, we assumed:

H4: 'Pleasure' leads to more pleasant anticipation for the upcoming car than 'Memories' and 'Pragmatic'.

H5: The overall car change is perceived more positively with 'Pleasure' than with 'Pragmatic'.

H6: The receipt of the upcoming car is perceived more positively with 'Pleasure' than with 'Pragmatic'.

However, Grund et al. (2024a) only surveyed users with an emotional attachment. Past research indicates that users with weaker emotional attachments to their cars primarily mentioned pragmatic aspects that would lead to positive emotions (Grund et al., 2024b). An app targeting the emotional aspects of attachment to the car may not have the desired effect on users who do not associate so many emotions with the car. Therefore, we assumed:

H7: 'Memories' and 'Pleasure' show stronger effects among emotionally attached users than among less attached users.

H8: The overall app is rated more positively by emotionally attached users than by non-emotionally attached users.

This study advances our understanding of which dimensions of product attachment can facilitate the emotional aspects of car changes. This research moves beyond acknowledging the emotional attachment to cars by developing and testing app-based approaches. Our work offers novel theoretical insights into the practical application of attachment theory in a transitional consumption context. It examines how leveraging product attachment through digital interventions can mitigate negative emotions during product farewell and foster positive feelings towards new acquisitions.

This research provides insights for UX practitioners in automotive and other industries. Demonstrating effective app functionalities that address users' emotional needs during product changes. The developed prototypes can serve as a blueprint for future interventions to enhance user well-being during product lifecycle changes.

6.2 Methods

6.2.1 Prototype design

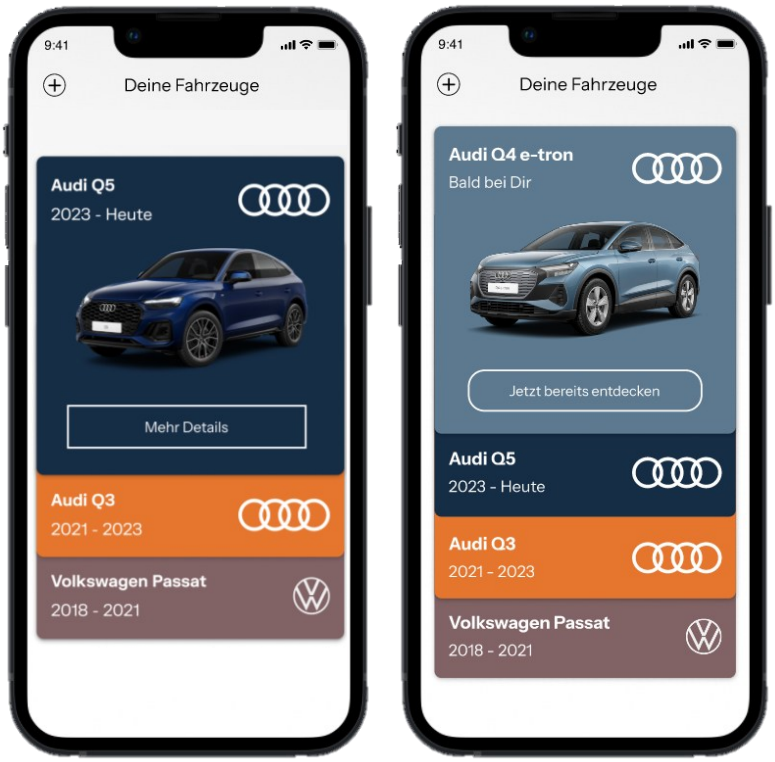
The prototype features were based on ideation workshops with different user groups. The task was to generate ideas that would emotionally support users in different use phases of the car (for details, see Grund et al., 2024). Additionally, in March 2023, two

ideation workshops were conducted with six employees from the automotive industry to generate further ideas for features and to evaluate their technical feasibility. Afterwards, the results were assigned to Hassenzahl's (2005) and Mugge's (2007) determinants to develop distinct concepts. The distinctiveness allows for assessing the determinants separately and how to best support emotional attachment during car change. Therefore, a card sorting method was employed, in which eleven independent UX researchers from the automotive industry assigned the ideas to the respective determinants. The ideas clearly attributed to specific determinants were further developed and evaluated by 19 automotive industry employees from various departments. This evaluation used the Kano Model (Kano et al., 1984). The Kano Model describes the relationship between the fulfillment of user requirements and satisfaction. By using the Kano Model, user requirements and expectations can be identified and considered during product development. Ideas of features can be evaluated based on their relevance and impact on user satisfaction and categorized accordingly (Kano et al., 1984). Ideas identified as factors of enthusiasm and potential to increase satisfaction were developed into features of the prototype and implemented for the evaluation in this study.

The prototype was a smartphone application, as it was the easiest to implement and likely to meet user requirements regarding personalization and transferability from one car to another. The prototype was created using Figma (2023) and followed the interaction principles of the usability standard DIN EN ISO 9241-110 (2020) as well as the usability heuristics for user interface design (Nielsen, 2024). The prototype app was presented on an iPhone 7. The start pages of the variants are shown in Figure 15.

Figure 15

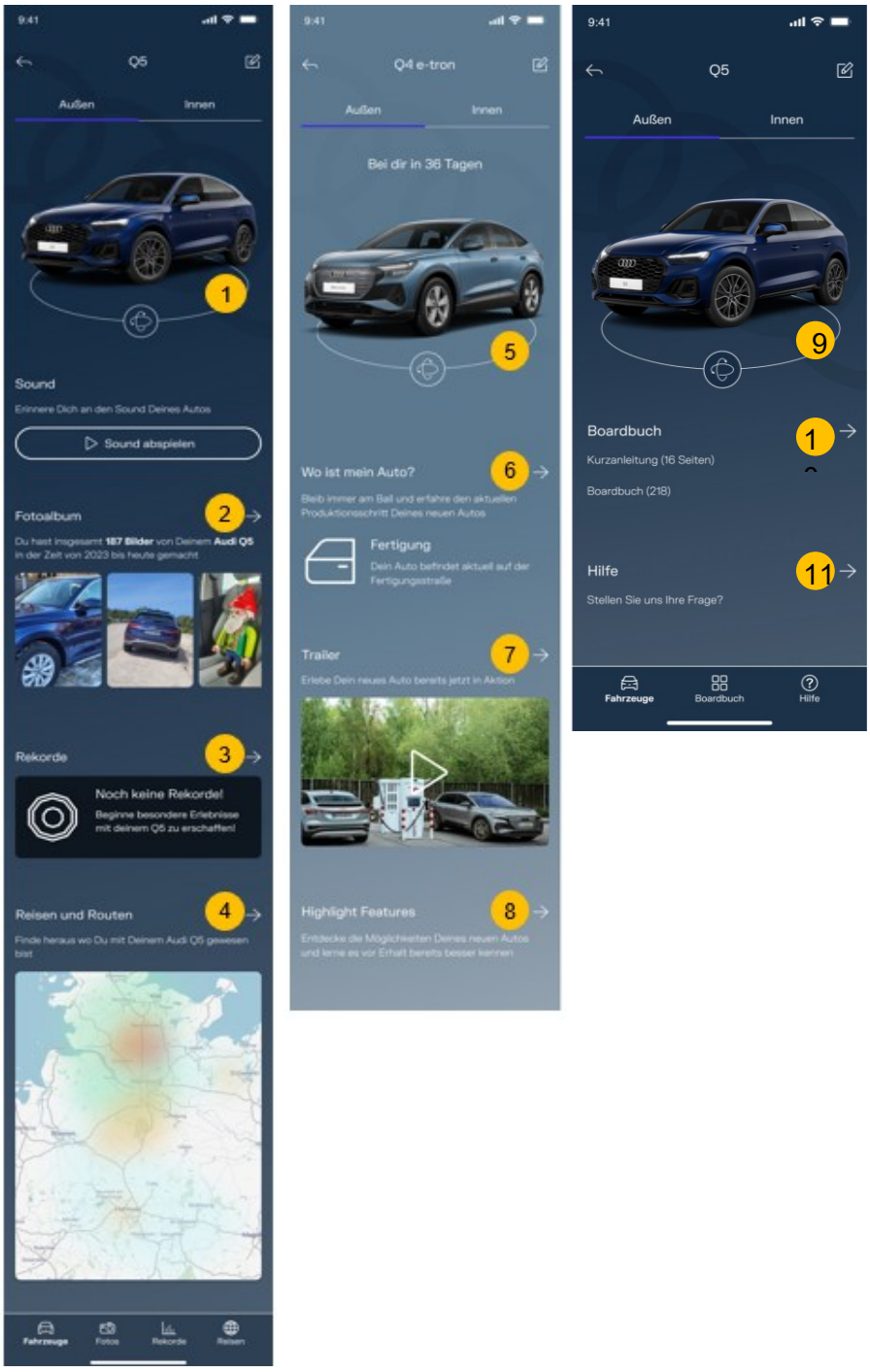
Start page of the 'Memories' and 'Pragmatic' variant (left) and the 'Pleasure' variant (right). The start page showed the previous cars, the current car, and in the 'Pleasure' variant, additionally, the upcoming car



Clicking on “further details” directed the participant to the overview pages (see Figure 16) of the respective car, where short overviews and links to features of the corresponding app variant were integrated.

Figure 16

Overview pages of 'Memories' (left), 'Pleasure' (middle), and 'Pragmatic' (right)



Note. (1), (5), and (9) show the 3D model of the respective car, 'Memories': (2) links to the photo album, (3) navigates to the records, (4) shows an excerpt of the heatmap and links to further travel details 'Pleasure': (6) opens the real-time tracking and live image, (7) directs to more video clips, and (8) provides explanations of new features in the car, 'Pragmatic': (10) opens the digital car manual, and (11) provides a help function

The 'Memories' variant allowed users to store memories of their previous car. The following features that can be primarily attributed to the evocation dimension were integrated for each car:

- 3D model: A 3D model of the respective car, including individual personalization, can be rotated to view it from all angles, both interior and exterior.
- Photo album: The photo album feature displayed all photos of the user's respective cars, similar to common gallery apps. Participants were briefed that an artificial intelligence (AI) would recognize the car in photos and videos taken by the user and automatically add it to the app. However, this AI functionality was not implemented in the prototype. Within the app, users could have a look at their photos in an overview or detail, mark them as favorites, or share them with friends. Additionally, users could access further information about the photos, such as other people recognized in the images, location, or AI-generated tags. A filtering option was also integrated, allowing users to select individual cars from their history or the current car to view specific photos.
- Records: The records feature allowed users to view either statistics or records of the individual cars. Statistical values included average fuel consumption, total distance traveled with the car, and average speed. A comparison between the cars was possible as well. Records referred to values where the user achieved the highest value with a particular car, such as the most kilometers driven in a day, the most trips taken, or the most countries visited. Users could access additional information by clicking on the records. A filtering option was also available to display records and statistics for the selected car.
- Traveling: A heatmap illustrated the frequency of the user's trips with the respective car to various locations. Additionally, an overview of past vacation trips was provided, in which an AI-powered algorithm distinguished between daily commutes and vacation travels. Again, this AI functionality was explained to the participants but not implemented in the prototype. The overview included the date of each trip and the distance travelled. Upon selecting a specific trip, a map showed the route taken, intermediate stops, and photos of the trip. Thus, each day's journey could be retraced individually.

The 'Pleasure' variant was designed to stimulate anticipation and excitement for the upcoming car. To achieve this, we integrated features aiming to evoke feelings of pleasure and curiosity about the upcoming car. The start page differed from the 'Memories' variant only in an additional tile that displayed the upcoming car and allowed users to select it. Users could also access further details about each car, including 3D models of the interior and exterior. However, for the upcoming car, we implemented the following features:

- 3D model: Similar to the previous cars, the upcoming car was showcased as a 3D model crafted to closely resemble the car as ordered.
- Countdown: Above the 3D model, a countdown displayed the number of days remaining until the upcoming car would be received.
- Real-time tracking and live imaging: Like conventional shipment tracking features, we integrated a tracking function that allows users to monitor the production process of their upcoming car in real-time. After placing an order, users could access a detailed log of the car's production stages, enabling them to track the progress of their upcoming car at any time. Additionally, live images were displayed during specific production milestones, such as the painting process.
- New feature highlights: We provided an overview of the car's innovative features. They revealed further information and explanations on operation and technical implementation when clicked on. This allowed users to familiarize themselves with the car's capabilities and understand how to use them effectively.
- Video clips: We incorporated promotional video clips showcasing the car aesthetically pleasingly. These clips were accessible to the users anytime, providing an engaging and immersive experience.

The 'Pragmatic' variant served as a baseline, where integrating features that could evoke emotions was intentionally avoided; instead, providing a purely functional benefit was focused on. To ensure comparability with the other variants, the start page was identical to the one in the 'Memories' variant, without featuring the upcoming car to prevent anticipatory excitement.

- 3D model: As in the other variants, the respective cars' 3D models were displayed.

- Digital car manual: The car manual was digitally stored and enriched with hyperlinks between the table of contents and the corresponding pages, allowing easy navigation.
- Help function: In case of questions regarding the car's operation or features, users could access the help function, where they could pose their questions and receive intelligent explanations in response.

6.2.2 Research design

A mixed-method approach was employed. A qualitative method provided a deep understanding of the background, explaining why each variant of the app can assist with the car change and identifying potential problems. A quantitative method revealed statistically significant effects of the apps on emotional experiences. Therefore, semi-structured interviews were complemented with quantitative questionnaires at various stages. One experienced interviewer conducted all interviews, while a student assistant was present on-site or remotely to take notes and maintain records.

The study was based on a quasi-experimental 2 x 3 mixed between-within-subjects design. The two-level between-subjects variable 'Emotional Attachment' to the car distinguished between the manifestations 'emotional attachment to the car' (E+) and 'no emotional attachment to the car' (E-). This classification was based on selective questions during recruitment to obtain approximately equally sized groups. The three-level within-subjects variable 'App Variant' corresponded to the three different variants of the app: 'Memories', 'Pleasure', and 'Pragmatic', with a randomized order of presentation to the participants during the study to minimize potential judgmental biases. As it was a semi-blind procedure, the participants were unaware of both the intended goal of the app variants and the fact that different groups were considered in terms of emotional attachment to the car.

6.2.3 Quantitative measurements

The study was conducted in Germany, so all communication was done in German. In the case of integrating English questionnaires, the questions and items were translated into German. For this report, all questions and items are in English - these are either the original wording (in the case of originally English questions or items) or translated to English (in the case of originally German items).

Emotional Attachment.

- Inclusion of other in the self (IOS) scale. The single-item IOS scale developed by Aron et al. (1992) measures how close a participant feels to another person, group, or object. Participants are presented with seven pairs of circles overlapping to varying degrees, ranging from two separate circles that only touched (1) to two circles that almost completely overlapped (7). One circle is labelled "Self" and the other is labelled "Other", which in this study was replaced with "car".
- Product Attachment Scale (PAS). The PAS developed by Mugge et al. (2005) measures product attachment based on the dimensions: memories, pleasure, self-expression, and group affiliation. The participants express their agreement on a 7-point Likert scale ranging from 'strongly disagree' (1) to 'strongly agree' (7). The scale was adapted to the automotive context. The items were presented in a randomized order. The items and Cronbach's alpha for each dimension are listed in Table 25. The internal consistency of the scales was evaluated as high to excellent for all dimensions except for group affiliation, which had questionable internal consistency.

Emotionality in the scenario of a car change.

- Self-Assessment Manikin (SAM) Scale. The SAM scale (Bradley & Lang, 1994) was used to measure the valence and arousal during the car change, the farewell to the previous car, and when receiving the upcoming car. This is a non-verbal pictorial assessment technique measuring emotional assessment along the dimensions of valence (unhappy - happy), arousal (calm - stressed), and dominance (little control - full control) using cartoons on a 9-point scale. We omitted the dominance scale because it was not relevant to this study. The SAM Scale is a widely used and validated instrument.

Table 25

Items of the Product Attachment Scale (PAS) and Cronbach's Alpha

Dimension	Cronbach's α	Item
Product attachment	.88	I am very attached to my car
		My car has no special meaning to me*
		My car is very dear to me
		I have a bond with this car
Memories	.94	My car reminds me of people or events that are important to me
		My car makes me think back of someone or something that has happened
		I see my car as a reminder of certain people or events
		Through my car I think back to certain people or events
Pleasure	.90	I enjoy my car
		It is a pleasure to use my car
		I feel good when I use my car
Self-expression	.85	My car reflects who I am
		Other people can tell by my car what kind of person I am
		My car fits my identity
		My car suits me
		My car says nothing about me as an individual*
Group affiliation	.69	My car indicates that I am a car owner
		Through my car I feel connected to other car owners
		Through my car I belong to the group of car owners

Note. * Indicates a reversed item

Evaluation of the App.

- Questions on app effects. To test the intended goal of the app variants, a questionnaire on the app effect was created with the following questions:
  1. How well can you retrieve memories from the car using this variant?
  2. How strongly do you experience anticipation for your upcoming car through this variant?
  3. How well can this variant emotionally help you during a car change?

  The questions were answered on a 5-point Likert scale ranging from 'not at all' (1) to 'completely' (7).

- User Experience Questionnaire (UEQ). The UEQ developed by Laugwitz et al. (2008) evaluates the user experience of interactive products across pragmatic quality aspects (perspicuity, efficiency, and dependability), hedonic aspects (stimulation and novelty), and attractiveness. The items were presented as semantic differentials, each consisting of two opposing adjectives. The order of the terms in each item was randomized. A seven-point scale was used, with items from -3 (most negative response) to +3 (most positive response). Values between -0.8 and 0.8 were considered neutral (Schrepp, 2015). The collected data was compared to a benchmark for other interactive products.
- Net Promoter Score (NPS). The NPS (Reichheld, 2003) is a single-item questionnaire to measure customer loyalty by the likelihood of users recommending a product to others. The question "How likely are you to recommend our product to a friend or family member?" is answered on a scale from very unlikely (0) to very likely (10). The respondents are categorized into three groups:
  a) Promoters (scores of 9 or 10) are the most satisfied users who are very likely to recommend the product.
  b) Passives (scores of 7 or 8) are users who were satisfied with the product but would not recommend it.
  c) Detractors (scores between 0 and 6) are the most dissatisfied users who might even advise their friends and acquaintances against the product.

Analogous to Reichheld (2003), the NPS is calculated by subtracting the percentage of detractors from the percentage of promoters:

NPS = Promoters (in % of all respondents) - Detractors (in % of all respondents)

The score range is between -100 and +100.

6.2.4 Procedure

Upon arrival, the participants were informed about the procedure and that they would be presented with three variants of a mobile application designed to provide emotional support during the process of changing cars. The specific goals of each variant were not disclosed to avoid influencing their responses. Participants were assured that their data would be anonymized and asked to consent to audio recording. The interview

commenced thereafter. The interview consisted of six thematic blocks, each comprising qualitative questions and quantitative questionnaires:

1. Emotional attachment to cars. The first part served as an introduction to the topic. Participants were asked about their general experiences with car usage, emotional attachment, and memorable events related to their car. They were then presented with the IOS scale and asked to rate their attachment to their current car or, if they had recently changed cars, their previous one. Finally, participants completed the PAS concerning this car.
2. Car change. Participants were asked to identify factors influencing their decision to change cars. They were also asked to describe their emotions when leaving their previous car and during the changing process, as well as any particular emotional moments. Additionally, participants were asked to explain what helped them to cope emotionally during this time. Afterwards, they were asked to evaluate the valence and arousal of their emotions using the SAM during the car change process.
3. App Variant 1. In parts 3, 4, and 5, participants interacted with the various app variants. They could operate the app independently. Initially, participants were informed that they would be engaging with a prototype, which might exhibit technical issues and would not display their personal cars; instead, examples of cars were shown. However, they were asked to imagine that the app would showcase their own car history. Participants were informed that they would need to complete two to three test tasks to ensure they explored all features of the variant. Furthermore, they were reassured that there were no right or wrong answers and were encouraged to explore the app and share their thoughts freely. They could then examine the app variant, ask questions, and seek assistance from the experimenter if needed. Once participants had explored all features of the variant, they were asked to complete a questionnaire regarding the app's effects. Subsequently, they were presented with the SAM scale three times and asked to rate the valence and arousal of their emotions concerning the farewell from their previous car, the receipt of an upcoming car, and the overall car change.

4. App Variant 2. The procedure for the second variant of the app was the same as for variant 1.
5. App Variant 3. The procedure for the third variant of the app was the same as for variant 1.
6. Summary and overall concept. In the last part of the study, the participants were asked to evaluate which variant would best help them during a car change. Subsequently, they were informed that the three variants would be integrated into one app. Participants were then asked about their intention to use such an app. Following this, they were asked to evaluate the overall concept of the app using the UEQ. Next, participants were asked to complete the PAS again, assuming they had access to such an app. Then, they were presented with the NPS and asked about potential improvements or additional features for the app. Finally, the participants were thanked for their participation and escorted to the exit.

6.2.5 Recruiting and sample

The interviews were conducted from November to December 2023, in a separate testing room in our office buildings in Berlin and Munich. Each session lasted approximately 75-90 minutes. All interviews were recorded with the participants' consent for data analysis. Participants could withdraw from the study without fear of negative consequences. No ethical concerns were recognized.

The study included $N = 43$ participants, with $n = 22$ in Munich and $n = 21$ in Berlin. Initially, a sample of 44 was planned, but one participant had fallen ill at short notice and could not be replaced. With this sample size, we followed the recommendations of Budiu and Moran (2021). A recruitment agency recruited and incentivized the participants. They were contacted by email and asked about the inclusion criteria. All participants owned or leased a car that they used regularly (at least 5,000 km/year) and either planned to change their car within the next six months or changed it in the last six months. All participants spoke fluent German and owned a smartphone. Participants' ages were collected in categories ranging from 18 to 65 (see Table 26).

Table 26

Age distribution of the sample

Age category	Number (*n*)
18 – 29	3
30 – 39	12
40 – 49	9
50 – 59	11
60 – 65	8

Emotional attachment to the car was assessed during recruitment to ensure similar group sizes, using the questions developed by Grund et al. (2025b). Participants were asked to respond to seven questions, expressing their agreement on a 4-point Likert scale ranging from 'strongly disagree' (1) to 'strongly agree' (4). The questions included, for example, "I simply love this car" or "I primarily see my car as a means of transportation" (inverted). Cronbach's alpha was calculated to determine the internal consistency of the questionnaire. Internal consistency was between acceptable and good, with Cronbach's alpha = .75 for positive affect. Participants who responded with a score of 3 or 4 on at least 5 of 7 questions (or 1 or 2 on inverted questions) were assigned to the E+ group (*n* = 23) while the others were assigned to the E- group (*n* = 20). The gender-specific distribution is shown in Table 27.

Table 27

Gender distribution by user group

Gender	Number (*n*)	
	E+	E-
Male	13	14
Female	9	7

Note. E+: participants with emotional attachment to their car; E-: participants without an emotional attachment to their car

6.2.6 Data analysis

To maintain privacy, each participant was assigned a label such as 'M22', where the first letter indicates the city where the study was conducted ('M' for Munich, 'B' for Berlin). The quantitative data were prepared and initially analyzed using descriptive statistics with the help of Microsoft Excel 2016 and IBM SPSS Statistics (Version 27).

Due to the small sample size (N < 50), the normality of the distribution was tested using the Shapiro-Wilk test (p > .05). Additionally, the homogeneity of variance of the sample was checked using the Levene test (p > .05). Sphericity was assessed using the Mauchly test (p > .05). Depending on the research question, a repeated ANOVA or mixed ANOVA was calculated if the requirements were met. Since ANOVA is very robust against violations of normality (Vasey & Thayer, 1987), it was still calculated if normality was not met but the other assumptions were satisfied. If the assumption of sphericity was violated, a Greenhouse-Geisser correction was performed, as this is the most conservative correction option. To calculate differences between the app variants, contrasts were used for directed hypotheses, as these have high statistical power, and the effect size can be interpreted easily. For non-directed hypotheses and if only 'Emotional Attachment' was included in the analysis, *t*-tests were conducted. A Bonferroni-Holm correction was employed when necessary. The effect size was calculated using an online calculator (Hemmerich, 2015).

The audio recordings of each session were transcribed verbatim and compared to the observer's notes. The qualitative data were analyzed using MAXQDA software (VERBI Software, 2018). The qualitative content analysis followed the recommendations of Kuckartz (2016). A deductive-inductive approach was used to code and categorize the data. The first author established a preliminary category system based on the thematic blocks from the semi-structured interview guideline, the product quality dimensions outlined by Hassenzahl (2005), and the results of previous research (Grund et al., 2024). This system was then refined inductively by analyzing relevant text passages. Additional categories were added, and a hierarchical structure was developed. This iterative process continued until the category system reached saturation, i.e., no further modifications were required. An experienced student assistant developed a category system independently of the first author. Finally, both category systems were compared, and discrepancies were discussed to arrive at a final system, which the second author reviewed.

6.2.7 Quality criteria

This study used established methods for qualitative data collection and analysis. The criteria outlined by Miles and Huberman (1994) were adopted to ensure the credibility of the findings. Throughout the entire research process, at least a second experienced researcher was involved in the study's planning, implementation, and analysis. The

interviewer was experienced in mixed-method interviewing. The voluntary attendance of all participants established an open and honest atmosphere for discussion. We ensured the study's *reliability* through a consistent data collection approach. A comprehensive interview guide ensured all relevant topics were covered during each interview, guaranteeing a standardized process while allowing for individual dynamics. To ensure scientific *transparency*, all discussions were recorded and logged. In addition, the researchers routinely discussed the analysis procedures and documented each step. By including direct quotes from participants, the results were presented more comprehensively. *Transferability* was achieved by transparently explaining the research design, data collection methods, and analysis procedures.

6.3 Results

6.3.1 Review of grouping

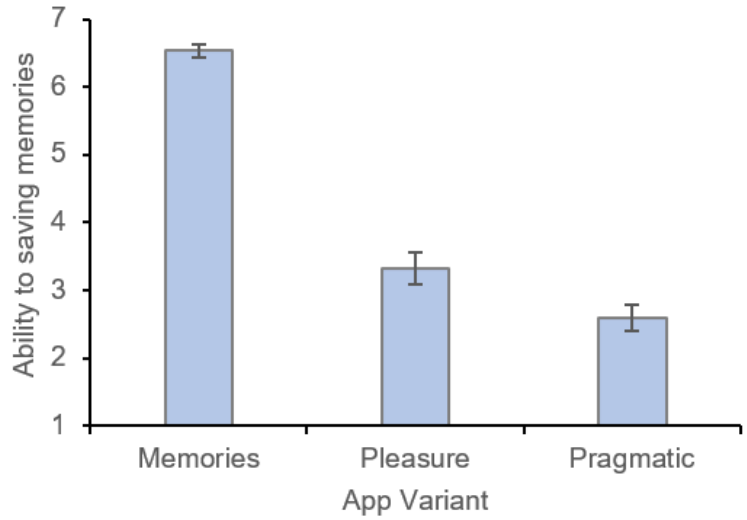
Based on the recruiting questionnaire, participants were divided into two groups, E+ and E-. This classification was validated using the IOS scale and the PAS. We expected the IOS and PAS scores to be higher in the E+ group than in the E- group. The E+ group reported a high level of attachment to their car (M = 5.35, SD = 1.40), consistent with their responses on product attachment of the PAS (M = 5.90, SD = 0.90). In contrast, the E- group scored in the middle range on both scales (IOS: M = 4.10, SD = 1.41; PAS: M = 4.69, SD = 2.39). An independent samples t-test revealed a statistically significant difference between the E+ and E- groups in terms of their emotional attachment to their car on the IOS scale ($t(41) = 2.90$, $p = .003$, $d = .89$) and the PAS ($t(41) = 3.20$, $p = .002$, $d = .98$). According to Cohen’s (1988) guidelines, this represents a large effect size, indicating the group assignment by the recruiting questionnaire was successful.

6.3.2 Effect of the app variants

To examine whether the self-designed app variants achieved the intended goals, we analyzed the questions on the app effect. The results showed participants using the 'Memories' app variant reported being able to retrieve memories very well (M = 6.53, SD = 0.59), which was significantly higher than the values for the 'Pleasure' (M = 3.33, SD = 1.67) and 'Pragmatic' (M = 2.60, SD = 1.29) variants. The results are shown in Figure 17.

Figure 17

Means and standard errors (SE) for how well the app variants can save memories

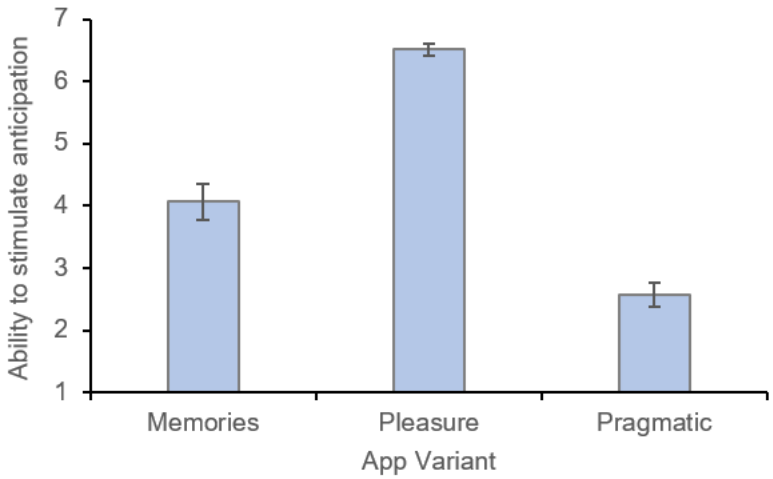


The ANOVA with the within-subject factor 'App Variant' revealed significant differences between the app variants in terms of their ability to support memory retrieval ($F(2,82) = 140.26$, $p < .001$). The 'Memories' app variant was rated highest, with a mean difference of 3.58 ($SE = 0.19$, $p < .001$, partial $\eta^2 = .90$).

The participants reported experiencing very pleasant anticipation for the upcoming car when using the 'Pleasure' app variant ($M = 6.51$, $SD = 0.67$). This was less pronounced for the 'Memories' ($M = 4.07$, $SD = 1.91$) and 'Pragmatic' ($M = 2.58$, $SD = 1.26$) app variants. The results are depicted in Figure 18.

Figure 18

Means and standard errors (SE) for how well the app variants can stimulate anticipation for the upcoming car



The ANOVA with the within-subjects factor 'App Variant' revealed that the differences between the app variants were significant ($F(2,82) = 120.02$, $p < .001$). The 'Pleasure' app variant was rated highest, with a mean difference of 3.16 (SE = 0.21, $p < .001$, partial $\eta^2 = .85$).

The qualitative data also supported these results. We counted the number of participants who spontaneously mentioned that the respective app variant could store memories or trigger anticipation for the upcoming car. These results were compared to the other variants and are presented in Table 28.

Table 28

Number of participants who spontaneously said the variant can save memories or create anticipation

Age category	Memories	Pleasure	Pragmatic
Save memories	32	2	4
Create anticipation	10	28	5

It can be assumed that the participants felt to retrieve memories of their car using the 'Memories' variant better than with the other variants, which is consistent with H1. The 'Pleasure' variant triggered more pleasant anticipation for the upcoming car than the other app variants, which is consistent with H4. In conclusion, the results suggest the app variants achieved the intended goals.

Evaluation of the app effect. The third question of the questionnaire on app effect was to investigate whether the process of changing cars is perceived more positively through the feeling of being able to store memories or experiencing anticipation for the upcoming car. Overall, participants rated the 'Pleasure' variant as most helpful during the car change process (M = 5.77, SD = 1.25), followed by the 'Memories' variant (M = 4.05, SD = 2.08) and lastly the 'Pragmatic' variant (M = 2.56, SD = 1.44). The group-specific results are presented in Figure 19.

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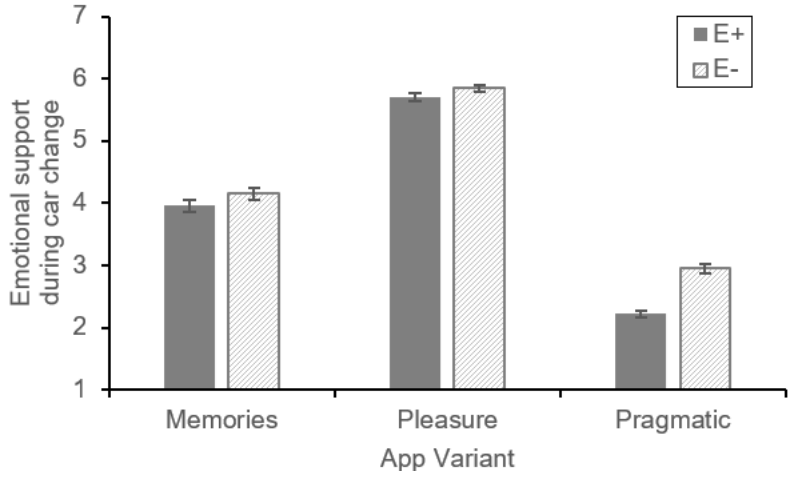
Figure 19

Mean values and standard errors (SE) of the assessment of emotional support by app variant and user group



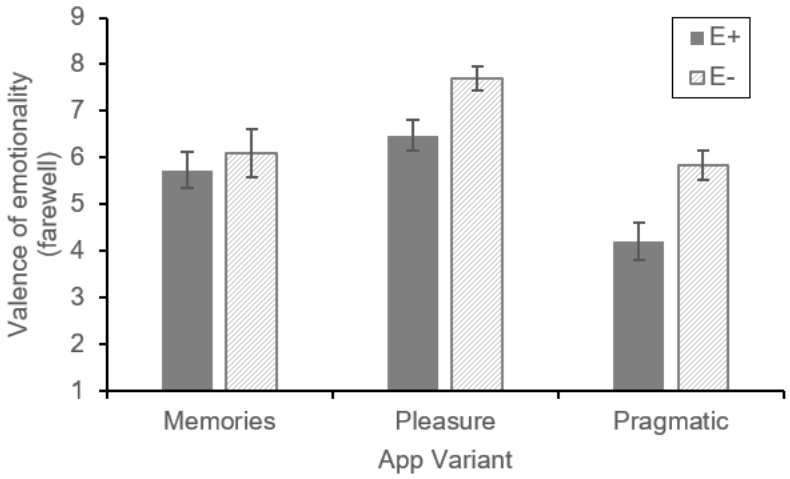
Note. E+: participants with emotional attachment to their car; E-: participants without an emotional attachment to their car

The mixed ANOVA revealed the differences between the variants were significant ($F(2,82) = 44.42$, $p < .001$). The 'Pleasure' variant was rated as more helpful than the 'Pragmatic' variant with a difference of 3.19 ($SE = 0.30$, $p < .001$, partial $\eta^2 = .73$) and as more helpful than the 'Memories' variant with a difference of 1.72 ($SE = 0.36$, $p < .001$, partial $\eta^2 = .35$). The 'Memories' variant was rated as more helpful than the 'Pragmatic' variant with a difference of 1.47 ($SE = 0.35$, $p < .001$, partial $\eta^2 = .30$). The results are consistent with H2 and H5. There were no indications of differences between the E+ and E- groups ($F(1,41) = 0.84$, $p = .366$) nor an interaction effect ($F(2,82) = 44.42$, $p = .636$).

Evaluation of the emotional valence. *Valence regarding the farewell from the previous car:* Emotionally attached participants experienced fewer positive feelings during the farewell from the car ($M = 4.22$, $SD = 1.91$) than emotionally unattached participants ($M = 5.85$, $SD = 1.42$). Using the 'Memories' variant, the feelings in both groups became more positive (E+: $M = 5.74$, $SD = 1.89$; E-: $M = 6.1$, $SD = 2.27$). With the 'Pleasure' variant, the feelings in both groups became even more positive (E+: $M = 6.48$, $SD = 1.59$; E-: $M = 7.70$, $SD = 1.13$). This is shown in Figure 20

Figure 20

Mean values and standard errors (SE) of the valence of emotionality regarding the farewell to the previous car by app variant and user group



Note. E+: participants with emotional attachment to their car; E-: participants without an emotional attachment to their car

The assumption of sphericity was not met (p = .012). Therefore, a Greenhouse-Geisser correction was performed. Since the Box's test indicated the covariance matrix was not equal, we cannot interpret the interaction effect. Significant differences were found between the user groups (F(1,41) = 10.207, p = .003, partial η² = .199). These effects are due to group differences in the app variant 'Pleasure' (t(41) = 2.862, p = .014, d = 0.875) and 'Pragmatic' (t(41) = 3.141, p = .009, d = 0.960). Additionally, for the within-subjects factor 'App Variants', significant differences were found (F(1.67,68.39) = 16.46, p < .001, partial η² = .286). The contrast calculation revealed significant differences between all variants, with the largest effect between the 'Pleasure' and 'Pragmatic' variants (see Table 29). Nevertheless, the farewell of the previous car is perceived less negatively with 'Memories' than with 'Pragmatic', which is consistent with H3.

Table 29

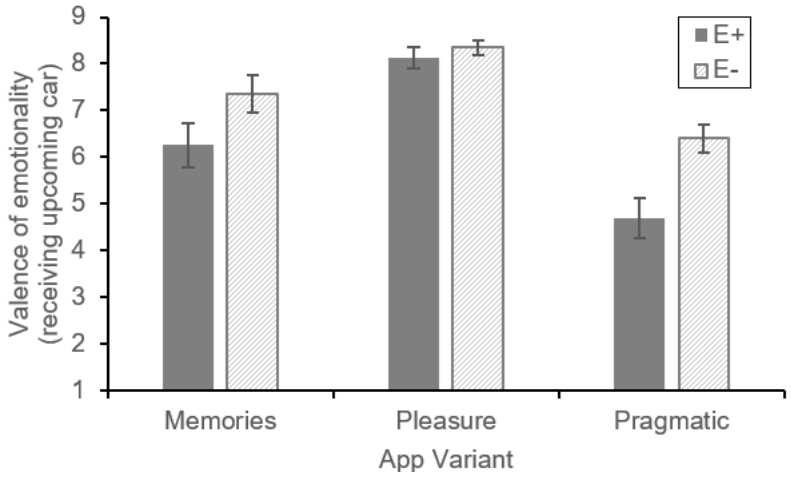
Contrast calculation for the valence regarding the farewell from the previous car to compare the app variants

Contrast	*F*	*p*	Partial η²
Memories vs. Pragmatic	4.28	.045	.095
Pleasure vs. Pragmatic	49.75	.000	.548
Memories vs. Pleasure	11.47	.002	.219

Valence given receiving the upcoming car: With the baseline variant 'Pragmatic', emotionally attached participants exhibited feelings in the medium range given receiving the upcoming car (*M* = 4.70, *SD* = 2.10), while emotionally unattached participants were more positive (*M* = 6.40, *SD* = 1.39). When using the 'Memories' variant, feelings in both groups became more positive (E+: *M* = 6.26, *SD* = 2.22; E-: *M* = 7.35, *SD* = 1.79) than with the variant 'Pragmatic'. The 'Pleasure' variant further increased positivity in both groups (E+: *M* = 8.13, *SD* = 1.10; E-: *M* = 8.35, *SD* = 0.67). This is illustrated in Figure 21.

Figure 21

Mean values and standard errors (SE) of the valence of emotionality in view of receiving the upcoming car by app variant and user group



Note. E+: participants with emotional attachment to their car; E-: participants without an emotional attachment to their car

The assumption of sphericity was not met (*p* = .041). Consequently, a Greenhouse-Geisser correction was applied. Since the Box's test indicated a lack of equality in the covariance matrices (*p* = .009), we cannot interpret the interaction effect. Significant differences were observed between the user groups (*F*(1, 41) = 7.97, *p* = .007, partial η^2 = .163). These effects are due to group differences in the app variant 'Pragmatic' (*t*(41) = 3.087, *p* = .012, *d* = 0.944). Furthermore, significant differences were found for the within-subjects factor of 'App Variants' (*F*(1.743, 71.482) = 37.18, *p* < .001, partial η^2 = .476). Contrast analysis revealed significant differences between all variants, with the largest effect observed between the 'Pleasure' and 'Pragmatic' variants (see Table 30). This is consistent with H6.

Table 30

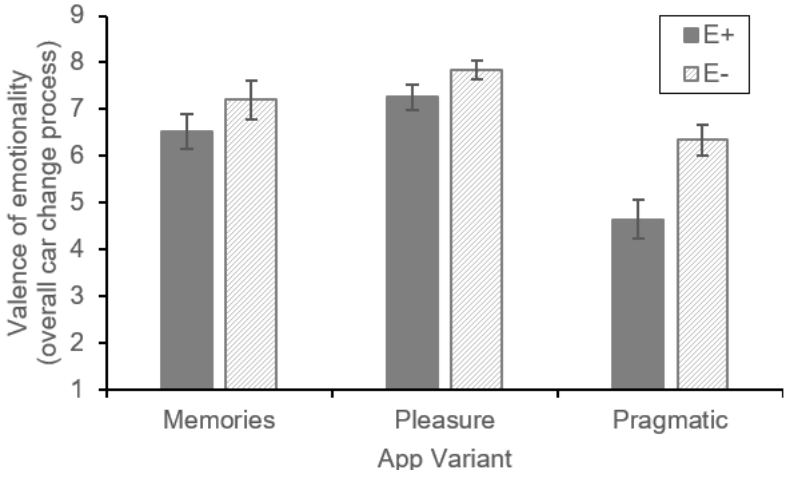
Contrast calculation for the valence given the upcoming car to compare the app variants

Contrast	*F*	*p*	Partial η²
Memories vs. Pragmatic	11.72	.001	.222
Pleasure vs. Pragmatic	95.91	<.001	.701
Memories vs. Pleasure	24.98	<.001	.379

Valence regarding the overall car change process: Given the overall car change with the baseline variant 'Pragmatic', emotionally attached participants' feelings were in the medium range (*M* = 4.65, *SD* = 1.97), while emotionally unattached participants were more positive (*M* = 6.35, *SD* = 1.46). When using the 'Memories' variant, feelings in both groups became more positive (E+: *M* = 6.52, *SD* = 1.75; E-: *M* = 7.20, *SD* = 1.85). The 'Pleasure' variant further increased positivity in both groups (E+: *M* = 7.26, *SD* = 1.29; E-: *M* = 7.85, *SD* = 0.88). This is illustrated in Figure 22.

Figure 22

Mean values and standard errors (SE) of the valence of emotionality regarding the overall car change process by app variant and user group



Note. E+: participants with emotional attachment to their car; E-: participants without an emotional attachment to their car

Significant differences were found for the within-subjects factor of 'App Variants' ($F(2, 82) = 25.173$, $p < .001$, partial $\eta^2 = .380$). Contrast analysis revealed significant differences between all variants, with the largest effect observed between the

'Pleasure' and 'Pragmatic' variants (Table 31). This again is consistent with H2 and H5.

Table 31

Contrast calculation for the valence regarding the overall car change process to compare the app variants

Contrast	*F*	*p*	Partial η²
Memories vs. Pragmatic	16.97	<.001	.293
Pleasure vs. Pragmatic	53.47	<.001	.566
Memories vs. Pleasure	6.67	.014	.140

Furthermore, significant differences were observed between the user groups ($F(1, 41) = 8.163$, $p = .007$, partial $\eta^2 = .166$). These effects are due to group differences in the app variant 'Pragmatic' ($t(41) = 3.171$, $p = .009$, $d = 0.970$). The interaction effect was not significant ($F(2, 82) = 2.18$, $p = .119$), which is inconsistent with H7.

Evaluation of the qualitative data. Participants were asked which variant would help them emotionally the best during the car change. The majority ($n = 22$) indicated the 'Pleasure' variant to be the most helpful, as it increased their anticipation of the upcoming car the best. Participant B23 reported: "I think the variant with the upcoming cars helps me the best, because I already have a sense of anticipation for the upcoming car. That outweighs everything and helps me let go of the previous one". Other participants highlighted that following the “birth of the car” (M03) would increase the attachment to the car from the start: "You can already be attached to the car from the beginning. Yes, that would increase the attachment to the upcoming car." (M02).

The 'Memories' variant was rated as the most helpful by $n = 13$ participants, as it allows memories to be preserved:

> I have the photos and can recall the memories again. Yes, it is not gone, is it? (…) You can look at the photos of the previous car and that is a wonderful thing. And above all, everything is in one place (M03).

However, some participants also reported the 'Memories' variant would make the car change more difficult, as it would increase their emotional attachment to the previous car: "That would make it worse for me, all of it. (...) Because it emotionally increases the attachment to the previous car, so I cling to it" (M07).

Some participants could not decide and explicitly wished for a combination of both variants (*n* = 7) to utilize the advantages of both. Only one participant rated the 'Pragmatic' variant as the most helpful.

6.3.3 Overall user experience of the app

The UEQ scales were examined to investigate the app's overall user experience. The raw data were transformed so that the most positive value corresponded to +3 and the most negative value to -3. On all scales, both groups rated the overall app positively, as the values are greater than 0.8. In the benchmark attractiveness, perspicuity, stimulation, and originality were rated as excellent, meaning the overall app belongs to the top 10% of product ratings. The scales' efficiency and dependability achieved a good result, indicating 10% of the results were better and 75% were worse. The mean values by group are presented in Table 32.

Table 32

Means (M) and standard deviations (SD) for the dimensions of the User Experience Questionnaire (UEQ) by user groups and results of a test of between-subjects effects

Scale	E+		E-		*df*	*t*	*p*	*d*
	M	*SD*	*M*	*SD*				
Attractiveness	2.23	0.70	1.94	0.64	41	1.40	.084	.427
Perspicuity	2.24	0.61	2.10	0.47	41	0.82	.207	.250
Efficiency	1.76	0.75	1.44	0.64	41	1.51	.070	.461
Dependability	1.73	0.74	1.40	0.59	41	1.60	.059	.488
Stimulation	2.05	0.70	1.69	0.61	41	1.82	.038*	.556
Novelty	2.01	0.87	1.99	0.64	41	0.10	.461	.031

Note. E+: participants with emotional attachment to their car; E-: participants without an emotional attachment to their car; * indicates a significant result; $p < .05$

To check for significant differences between the groups in their ratings on the scales, a *t*-test for independent samples was calculated for each scale. Although the E+ group tended to rate the overall variant of the app higher, the difference was significant only on the stimulation scale. The other dimensions did not show significant differences, which is inconsistent with H8. Stimulation and novelty, which belong to hedonic qualities, were rated slightly better (M = 1.94, SD = 0.66) than pragmatic qualities such as perspicuity, efficiency, and dependability (M = 1.79, SD = 0.51), with both qualities being rated very positively.

Additionally, the NPS was used to examine whether participants would recommend the overall app to friends and family. An overall NPS score of 58.14 was achieved (E+: 60.87; E-: 55.00), which is rated as great (Raileanu, 2024). In both groups, the majority could be identified as promoters and would recommend the app. The number of participants by NPS category and group is presented in Table 33.

Table 33

Number of participants according to the Net Promoter Score (NPS) categories by user group

NPS category	E+	E-
Detractor	0	1
Passive	9	7
Promoter	14	12

Note. E+: participants with emotional attachment to their car; E-: participants without an emotional attachment to their car

These findings were aligned with qualitative data. Almost all participants (*n* = 37) reported that they would like to use the overall app. "But I think what it offers is genius. It is really funny and enjoyable. Yes, it cannot get any better" (M03). The novelty of this app was particularly appreciated: "It is quite innovative, I do not know of any apps like it. I think it is really cool that you can store the past, but also the new. (…) it is a very positive app" (B08). Some participants (*n* = 11) emphasized their desire to use such an app across different brands, allowing them to switch between car manufacturers without giving up the app's features.

> It needs to be clarified who offers it, and it would need to be promoted accordingly. It would be more attractive worldwide if it were not limited to just one brand. If it is limited to one brand, it is okay; it promotes the brand. But if I buy a BMW next and previously had a Hyundai, I would not use a VW app (M08).

6.3.4 Influence on product attachment

How product attachment changed through interaction with the app was investigated exploratively. The PAS was applied both before the interaction with the app and once at the end. The mean values by group are presented in Table 34. To test the results for significance, a repeated ANOVA was conducted for each determinant with the within-subject factor 'Time' and the between-subject factor 'Emotional Attachment'.

Table 34

Means (M) and standard deviations (SD) of the determinants of the Product Attachment Scale (PAS) before and after the interaction with the app by group

Scale	E+				E-			
	Before		***After***		***Before***		***After***	
	M	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
Product attachment	5.90	0.90	6.01	0.93	4.69	1.55	4.92	1.25
Memories	4.59	1.88	5.62	1.53	4.61	1.73	5.48	1.32
Pleasure	6.41	0.60	6.39	0.67	5.35	1.09	5.37	1.23
Self-expression	4.73	0.99	4.61	1.24	3.62	1.37	3.87	1.48
Group affiliation	3.77	1.75	4.16	1.80	3.67	1.43	4.23	1.63

Note. E+: participants with emotional attachment to their car; E-: participants without an emotional attachment to their car

Product Attachment: The Box's Test indicated the assumption of equality of covariances was not met (p = .017), hence the interaction term cannot be interpreted. Also, the assumption of equality of error variances for 'Product Attachment' before the interaction was not met (p = .022). There was no evidence that product attachment was higher after the interaction (F(1,41) = 2.09, p = .156). As previously discussed during the recruitment check, the group differences were significant.

Memories: The statistical assumptions for this analysis were met. After the app interaction, participants were able to recall memories of their car better (F(1,41) = 28.33, p < .001, partial η^2 = .409). There was no evidence of an interaction effect (F(1,41) = 0.23, p = .635) or group effect (F(1,41) = 0.02, p = .899).

Pleasure: The assumption of equality of covariances was met (p = .054). However, the assumption of equality of error variances for pleasure before the app interaction was not met (p = .022). There was no evidence of differences before and after the app interaction (F(1,41) < 0.01, p = .987) nor of an interaction effect (F(1,41) = 0.06, p = .811). The groups differed significantly (F(1,41) = 14.45, p < .001, partial η^2 = .261).

Self-Expression: The statistical assumptions were met. There was no evidence of differences before and after the app interaction (F(1,41) = 0.35, p = .557) nor of an interaction effect (F(1,41) = 2.94, p = .094). The groups differed significantly (F(1,41) = 6.13, p = .018, partial η^2 = .130).

Group Affiliation: The statistical assumptions were met. After the app interaction, participants felt more affiliated with a group than before (F(1,41) = 9.86, p = .003,

partial η² = .194). There was no evidence of an interaction effect ($F(1,41) = 0.33$, $p = .569$) or group effect ($F(1,41) < 0.01$, $p = .978$).

6.4 Discussion

The study reported here investigated whether storing memories of the previous car and creating pleasant anticipation for the upcoming car can emotionally support users during the car change. Previous research identified the car change as particularly emotional, as predominant feelings include not only sadness over parting with the previous car but also pleasant anticipation and uncertainty regarding the upcoming car (Grund et al., 2024). Two app variants were designed to address both determinants (memories and pleasure) of product attachment, besides a third baseline variant without any emotional trigger. Specifically, we examined the potential of the 'Memories' and 'Pleasure' variants to affect users' emotional experiences, memory preservation, and pleasant anticipation for the upcoming car. Additionally, we investigated the perception of these app variants among users with varying levels of general emotional attachment to their cars.

6.4.1 Main results

The hypotheses and their status (confirmed/rejected) are presented in Table 35.

Table 35

Hypotheses and their status, whether they are confirmed or rejected

	Hypotheses	Status
H1	'Memories' will better preserve memories with the previous car than 'Pleasure' and 'Pragmatic'.	✓
H2	The overall car change is perceived more positively with 'Memories' than with 'Pragmatic'.	✓
H3	The farewell of the previous car is perceived less negatively with 'Memories' than with 'Pragmatic'.	✓
H4	'Pleasure' leads to more pleasant anticipation for the upcoming car than 'Memories' and 'Pragmatic'.	✓
H5	The overall car change is perceived more positively with 'Pleasure' than with 'Pragmatic'.	✓
H6	The receipt of the upcoming car is perceived more positively with 'Pleasure' than with 'Pragmatic'.	✓
H7	'Memories' and 'Pleasure' show stronger effects among emotionally attached users than among less attached users.	X
H8	The overall app is rated more positively by emotionally attached users than by non-emotionally attached users.	X

Note. ✓ means confirmation, X means no confirmation

To investigate whether storing memories and experiences with the previous car supports users emotionally during the car change, we first examined whether the app variant 'Memories' achieves its intended goal of preserving memories. The participants reported that the 'Memories' variant helped them store and retrieve memories of their car more easily than 'Pleasure' and 'Pragmatic', which confirms H1. The quantitative results suggest that the 'Pleasure' and 'Pragmatic' variants could also store memories to some extent. This may be explained by the standard start page, which was largely identical in all variants and provided an overview of the current and past cars. The participants reported that this overview already triggered memories of their previous car. Furthermore, the 'Memories' variant can lead to moderate anticipation for the upcoming car. So, the participants indicated they would be pleased if the upcoming car would also be listed in the app, and they could store further memories with it. This is in line with the results of Grund et al. (2024), who suggested users also want to create memories with their car during the familiarization phase.

Regarding the overall car change process and the farewell from the previous car, our results show that the 'Memories' variant supports users emotionally more than the baseline variant 'Pragmatic', which confirms H2. In addition, it makes the farewell from the previous car more pleasant compared to the 'Pragmatic' variant, thereby confirming H3. The qualitative data reveal that some users feel reassured with the 'Memories' variant, knowing their memories will not be lost, which may facilitate the farewell. This finding aligns with Fraine et al. (2007) and Grund et al. (2025b), who noted that negative emotions during the car farewell are partly due to the loss of associated memories. The 'Memories' app variant can mitigate this. However, our results indicate the farewell is still most convenient with the 'Pleasure' variant. This may be explained by the fact that the 'Memories' variant causes other participants to experience an increased emotional attachment to the previous car, making the farewell more challenging. The reason for this is that the 'Memories' variant addresses the dimensions of evocation and memories, which can enhance emotional product attachment (Hassenzahl, 2001; Mugge et al., 2005; Norman, 2005), and the intention to use the product is more persistent (Wang & Wang, 2023).

It was examined whether the app variant 'Pleasure' achieves its intended goal of generating excitement for the upcoming car, to answer whether stimulating anticipation for the upcoming car helps users emotionally during the car change.

Participants reported the 'Pleasure' variant strengthened their anticipation for the upcoming car significantly more than the other two variants, which confirms H4. We found no differences between users with emotional attachment and those without.

Regarding the overall car change process, the quantitative and qualitative results show that the 'Pleasure' variant helps users emotionally better than the baseline variant 'Pragmatic' (confirming H5) and 'Memories'. The 'Pleasure' variant strengthens the attachment to the upcoming car by eliciting Stimulation and Pleasure. This is evident in the fact that the 'Pleasure' variant is rated most positively for acquiring the upcoming car. This confirms H6. The 'Pleasure' variant enhances anticipation and fosters an emotional attachment even before receiving the car. Therefore, it is comprehensible that the 'Pleasure' variant is most helpful for the car change process.

Contrary to our expectations, the 'Memories' variant and the 'Pleasure' variant achieved a similarly strong effect in both emotionally attached and non-emotionally attached users. Therefore, H7 is not confirmed. This suggests that the emotional aspects of the app are relevant regardless of emotional attachment to the car. However, the groups differed in evaluating the 'Pragmatic' variant. The non-emotionally attached users rated this variant as more helpful for the car change process. One explanation for this may be that non-emotionally attached users place a higher value on the pragmatic aspects of the car (Grund et al., 2024).

Overall, we can conclude that storing memories with the previous car and stimulating anticipation for the upcoming car can emotionally facilitate the car change process, with anticipation having an even greater effect than storing memories. This effect is observed regardless of whether users already have an emotional attachment to the car. Nevertheless, integrating of both variants into one solution is desirable.

Therefore, we further examined the perception of the overall app concept and found that the evaluation of pragmatic qualities did not differ between emotionally attached and non-emotionally attached users, thus not confirming H8. Regarding hedonic qualities, group differences were found in stimulation, with emotionally attached users being more stimulated by the app. There were also slight indications that emotionally attached users might rate the app as more attractive, although this was not significant. Finally, the overall app was rated very positively, especially the hedonic values. Consistent with these results, the majority of both groups would actively recommend the overall app. This underlines the relevance of hedonic qualities

(Hassenzahl, 2005) and the importance of user experiences (Kujala et al., 2011) for product acceptance.

Explorative analyses revealed that interaction with the app improved users' ability to recall memories and feel a sense of group affiliation. This aligns with the notion that digital tools can enhance emotional product attachment by facilitating memory retrieval and fostering social connections (Mugge et al., 2005; Hassenzahl & Monk, 2010). However, the increase in group affiliation was unexpected, as none of the variants were designed to address this. Maybe the related questions in the questionnaire were not understood very well, as evidenced by a lower Cronbach's alpha. This suggests group affiliation may not be the best dimension to measure emotional product attachment. There was no notable change in overall product attachment, pleasure, or self-expression. This suggests that while the app can enhance specific determinants of attachment, the overall attachment may require more prolonged and varied interactions. Furthermore, the prototype used in this study only targeted the memories determinant about the previous car. So, it is not surprising that there was no increase in the other determinants of product attachment.

To sum up, it is possible to elicit determinants of product attachment, according to Mugge (2007), or hedonic values, according to Hassenzahl (2005), through an app. With such an app, we follow Hassenzahl and Monks (2010) suggestion to give more importance to experiences and events, as these are essential for a good user experience. This study demonstrates the potential of an app to create a narrative around a product, thereby generating emotions and meaning. Although this study specifically focused on the car change process, the app can be utilized throughout the entire lifecycle of a car, as memories and experiences accumulate over time, thereby strengthening the attachment (Karapanos, 2013; Norman, 2005). These results have relevant implications for developing digital tools that aim to enhance emotional product attachment.

6.4.2 Limitations and future work

One limitation of the study was the relatively small sample size, which was not representative of car users. Furthermore, this study was conducted in two German cities, which may additionally limit its generalizability, especially to other countries,

cultures, or rural areas. Future research should consider a more diverse range of geographical and cultural contexts to increase the study's external validity.

Secondly, the study was conducted in an artificial environment using a prototype and imagining a car change. In the app-test, participants had to imagine the car history displayed in the app was their own, which may have led to a discrepancy in cognition. To address this limitation, the app should be evaluated in a real-world setting to validate the findings and ensure the study's effects also occur in practice. Furthermore, future research could investigate the long-term effects of such tools on user behavior and loyalty to their car or brand.

A third limitation of this study is a potential overlap between the different determinants presented by the apps, as the same start page was used. An improved separation of the variants would be interesting from a psychological perspective, as it allows for investigating more precisely which determinants lead to which effects. Nevertheless, the users who tested the variants preferred a combined variant for practical application.

Despite these limitations, the study provides valuable insights into how emotional product attachment can be strengthened. The findings from this study contribute significantly to the existing body of research on emotional product attachment, as they demonstrate the effectiveness of a novel approach to increasing product attachment and customer loyalty through a digital product. Furthermore, this study highlights the potential of digital interventions to enhance user experience and emotional connection with long-term used cars, which is a crucial aspect of product design and development. The results also underscore the importance of considering the entire usage cycle of a car when designing strategies to foster emotional attachment. Future research should explore whether the findings of this study can be replicated in other product categories beyond the automotive context and investigate the integration of additional determinants to provide a more comprehensive understanding of emotional product attachment. By doing so, researchers and practitioners can develop more effective strategies to promote emotional attachment and customer loyalty, ultimately increasing product satisfaction and retention.

6.4.3 Conclusion

It can be concluded that digital interventions can significantly impact the emotional management of changing cars. Three app variants were designed to (1) store memories of the previous car, (2) build anticipation for the upcoming car, or (3) serve as a baseline. Qualitative and quantitative methods revealed that stimulating anticipation makes the car change emotionally easier. Saving memories can also make the car change more pleasant, but it risks intensifying the attachment to the previous car and making the farewell more difficult. This research provides insights into strengthening emotional attachment through digital products. It underscores the potential of such interventions to improve user experience and emotional attachment to long-term consumer goods like cars. This emphasizes the need to consider the entire usage cycle when developing strategies to foster emotional attachment.

6.4.4 Tips for user experience practitioners

Based on our study, we identified these recommendations to assist UX practitioners:

- Utilize mixed-method approaches in investigating emotions. The qualitative approach provides a deeper understanding of the reasons behind participants' thoughts and actions, while the quantitative approach allows for the derivation of statistically significant effects.
- Embrace the entire product's lifecycle, from eager anticipation to fond farewell. Actively involve users even before receiving the product – this is a prime opportunity to build emotional attachments. Similarly, thoughtfully consider the farewell phase and the emotions it might stir. Designing for this entire cycle creates a more holistic and supportive experience.
- Prioritize hedonic aspects in product design and marketing. While users with weaker emotional attachments may also appreciate pragmatic features, emphasizing hedonic qualities offers benefits regardless of a user's existing emotional attachment.
- You do not always need to reinvent the product itself to deepen emotional attachment to it. Think about how digital interfaces can enhance memory, build anticipation, and create meaningful interactions around the product.

7. General Discussion

The present dissertation analyzes the emotional attachment of different user groups to their cars. Specifically, it examines which emotions are evoked in users by cars (RQ 1) and which characteristics of cars lead to emotional reactions (RQ 2). Furthermore, it investigates which determinants of product attachment are crucial for emotional attachment to cars (RQ 3) and how this emotional attachment changes over time (RQ 4). These research questions were investigated across various user groups, including owners, lessees, car sharing users, and renters (RQ 5). Additionally, approaches were identified, implemented, and evaluated to positively influence the emotional attachment to cars, especially during the car change, as this is highly emotional for the users (RQ 6).

Below, the main findings are summarized according to the research questions. Differences between user groups are discussed directly in the context of the respective research questions. Subsequently, the theoretical and practical implications of the results are comprehensively discussed. Furthermore, the strengths and limitations of this research are reflected, and future research hints are identified.

7.1 Summary of main findings

7.1.1 Which emotions are relevant in the context of cars?

This research provides consistent evidence across different studies and methods that cars are primarily associated with positive emotions (Chapters 2, 3, and 4). Notably, satisfaction, amusement, and pride are identified as dominant emotions across all user groups (owning, leasing, car sharing, and renting). Additionally, the feeling of connectedness is particularly important in all user groups except renting. At the beginning of usage, users also experience excitement and some uncertainty, as they need to get to know the new car first. Negative emotions mainly arise in connection with defects and malfunctions and during the farewell from the car. In these situations, users report feelings of sadness, frustration, anger, or pain of separation (Chapters 2 and 4).

7.1.2 Which characteristics of the car are relevant for an emotional attachment?

Hedonic qualities are crucial for emotional attachment to a car in all user groups (Chapters 2 and 3). Specifically, memories with the car, its appearance, and ownership are important for owners and lessees. Furthermore, lessees value a modern car that suits them. The results in Chapter 2 suggest that pragmatic aspects are the most important among car sharing users, such as small and functional cars. This observation is not confirmed in Chapter 3. Moreover, in Chapter 3, car sharing users highlight a good driving experience and the car's suitability to their needs. The absence of experiencing hedonic qualities, conversely, is a reason for a non-existent or weak emotional attachment in all user groups.

7.1.3 What determinants of an emotional attachment are relevant in the context of cars?

Owners exhibit the strongest emotional attachment to their cars, followed by lessees and then car sharing users (Chapters 2 and 3). Renters, however, mostly demonstrate no emotional attachment to their cars. Furthermore, differences occur between users of premium and volume cars across owners, lessees, and car sharing users. In general, a stronger emotional attachment exists to premium cars than to volume cars (Chapter 3).

The user groups do not differ in their feelings about how well the car reminds them of specific people or events in Chapter 2. However, quantitative data in Chapter 3 suggests that lessees associate memories less strongly with their cars compared to owners (Chapter 3). Especially, lessees of volume cars associate significantly fewer memories with their car than lessees of premium cars.

Pleasure appears to be a contributing factor to this attachment. All user groups experience enjoyment, happiness, and satisfaction through the car (Chapters 2 and 3).

Owners, lessees, and car sharing users do not differ in their feelings about how well they can differentiate themselves and express their personal identity through the car (Chapters 2 and 3). However, both lessees of a premium car and, to a lesser extent, owners of a premium car can express themselves better through the car than lessees or owners of a volume car. Conversely, car sharing users show no difference in self-expression between car classes (Chapter 3). Notably, renters cannot express

themselves through their cars. According to them, the limited option of selecting a specific car is a key reason for that (Chapter 2).

While car sharing users demonstrate the strongest sense of group affiliation, lessees, conversely, exhibit a weak sense of belonging user group. Especially, lessees of volume cars do not feel socially connected to other lessees (Chapters 2 and 3).

7.1.4 How does the emotional attachment to the car and emotions develop over time?

Four distinct emotional phases of car usage are identified for owners, lessees, and car sharing users: familiarization, everyday use, malfunctions and defects, and farewell (Chapter 2).

During the familiarization phase, emotional attachment increases (Chapter 2). This is supported by quantitative data (Chapter 3). Owners and lessees describe this initial period as an "infatuation" phase in which excitement for the new car dominates. Car sharing users, being new to the service, are initially somewhat skeptical about whether everything will work out (Chapters 2 and 4).

During the everyday use phase, emotional attachment plateaus or increases more slowly than initially observed (Chapter 2). Quantitative data also supports this trend (Chapter 3). Users report feeling familiar but also bored sometimes with the car. However, emotional attachment decreases if malfunctions or defects compromise functionality. This phase also exhibits the highest prevalence of negative emotions. When functionality is restored, emotional attachment returns to its previous levels (Chapters 2 and 4).

The farewell phase reflects a strong emotional attachment, wherein users often desire to avoid the replacement of the car. This phase is perceived as highly emotional, primarily characterized by grief associations with the loss of the previous car and its associated memories. Concurrently, users also express anticipation for the upcoming car, albeit connected with some uncertainty regarding whether it would meet their expectations. Consequently, the overall emotional experience of car change is ambivalent (Chapters 2 and 4).

7.1.5 How can an emotional attachment to the car be fostered?

The car change, consisting of the farewell to the previous car and receiving the upcoming one, has been identified as emotionally affecting (Chapters 2 and 4). Therefore, this use phase, in particular, has been further investigated. Preserving memories related to the previous car and stimulating pleasant anticipation for the upcoming car support the farewell process. Stimulating anticipation emotionally facilitates the car change and fosters an emotional attachment to the upcoming car. This effect is evident regardless of the extent of the users' emotional attachment to the previous car (Chapter 6). Preserving memories can emotionally ease the farewell compared to a control group as well. However, it may also foster the existing attachment to the car, regardless of the absolute degree of attachment. This can make the farewell more difficult. The results show that storing memories can strengthen the emotional attachment independently of the farewell phase, even during normal use (Chapter 6).

7.2 Theoretical implications

7.2.1 Emotions in the context of cars

The present research confirms and expands upon previous findings that identify the car as an object that goes beyond its mere functionality as a means of transportation and addresses the profound emotional and psychological needs of users (Eckholdt et al., 2013; Hassenzahl, 2018; Steg, 2005). In line with these studies, this dissertation shows that the car is an affective object, capable of evoking both positive and negative emotions.

Earlier research, such as Jordan (2000), primarily focused on pleasure as a central emotional response to products. The results in this dissertation demonstrate a broader spectrum of emotions to be relevant in the context of cars. In addition to pleasure, emotions like pride and satisfaction are also substantial. These results correspond with Desmet's (2002) assumption that positive emotions generally outweigh negative ones concerning products to which an emotional attachment exists.

According to the results of this dissertation, negative emotions in connection with the car mainly occur due to problems such as malfunctions and defects (Chapters 2 and 4). Furthermore, it was observed that users also experience negative emotions such as sadness or feelings of loss when parting with the previous car, for example,

at the end of its lifespan (Chapters 2 and 4). This observation underscores the relevance of the car as an emotionally meaningful object, the loss of which is perceived as an important event.

Aligning with existing theoretical frameworks, the findings of this dissertation support the distinction between instrumental and non-instrumental product qualities, as described by Thüring and Mahlke (2007). Similarly, Hassenzahl's (2005) model of hedonic and pragmatic qualities, as well as Mugge's (2007) determinants of product attachment, are confirmed by the results (Chapters 2, 3, and 4).

However, it is worth noting that some categories of product features were not clearly classifiable. For instance, new in-car features, due to their novelty, can be both stimulating and thus non-instrumental and hedonic. However, they can also facilitate the driving task and thus represent an instrumental and pragmatic quality.

The results of this dissertation suggest that hedonic qualities, in particular, are crucial for building a deep emotional attachment to the car (Chapters 2 and 3). The absence of these qualities can prevent the formation of such an attachment (Chapter 3). On the other hand, pragmatic qualities can be seen as 'hygiene factors' that are necessary for developing a deep emotional attachment but are insufficient on their own. However, their absence is perceived negatively and can impair user satisfaction. These findings are consistent with Diefenbach (2012).

7.2.2 Differences between user groups

The research provides empirical evidence that various user groups differ in the intensity and type of emotional attachment they form to a car. These results align with existing research demonstrating how ownership status and usage duration influence the development of emotional attachment (Bardhi & Eckhardt, 2012; Fraine et al., 2007; Schaefers, 2013).

Specifically, car owners develop a stronger emotional attachment to their cars than other user groups (Chapters 2 and 3). This attachment is primarily determined by memories associated with the car that accumulate over time. This aligns with Hassenzahl's (2005) dimension of evocation. The shared history owners experience with their car forms a foundation for their emotional attachment (Steg, 2005). Furthermore, the ability to personalize the car, which fosters identification with the object, appears relevant for owners. Moreover, premium cars can serve as status

symbols, contributing to the feeling among owners that they can express themselves (Chapter 3), and they perceive the car more strongly as a reflection of their social status (Sheller & Urry, 2000). This, in turn, further enhances the emotional attachment to premium cars compared to volume cars.

The emotional attachment of lessees to their cars is similar to that of owners, although it tends to be less pronounced and less strongly shaped by memories and identification (Chapters 2 and 3). This could be due to lessees having, on average, shorter usage periods and regularly transitioning to newer car models. Among lessees, stimulation is particularly important, which aligns with Hassenzahl's (2005) dimension. This is mainly manifested in the car's novelty. Changing cars regularly likely promotes a greater openness to new technologies and designs. Therefore, lessees could be more interested in becoming acquainted with the newest car features, knowing that they will change cars in the near future. However, lessees also form memory associations, particularly lessees of premium cars (Chapter 3). This may be because the experience is often more luxurious and, therefore, more memorable (Min, 2018). Like owners, lessees of premium cars also express themselves through the car more than lessees of volume cars do (Chapter 3).

Car sharing users also form an emotional attachment to the cars they use, though this attachment is less intense than that of car owners. Car sharing users prioritize practical qualities when forming an attachment. They develop an emotional attachment primarily through identifying with a sustainable and socially responsible lifestyle (Chapters 2 and 3). Car sharing users are frequently motivated by a sense of community and responsibility towards the environment. Using car sharing services allows them to reduce their environmental footprint while enjoying the car's flexibility. In this context, they use the car as a means of self-expression and social positioning (Mugge et al., 2010) rather than a traditional status symbol to express wealth. This combination of practical and ideological benefits helps car sharing users develop a unique form of emotional attachment, which differs from the attachments of owners and lessees. Consequently, it is less important for car sharing users whether the car is a premium or volume model (Chapter 3). However, they can still develop an attachment to a car if they use it regularly, as with station-based car sharing next to their domicile. This observation aligns with the findings of Fraine et al. (2007), who showed that emotional attachment to a car does not necessarily depend on ownership.

Instead, the regularity of interaction with the car seems to be a decisive factor, consistent with the results of Bardhi and Eckhardt (2012). However, it is often difficult for users to clearly distinguish between an attachment to the car itself and the concept of car sharing.

Analyzing rental car users supports the findings of Bardhi and Eckhardt (2012). Typically, users rent cars for a limited time, such as during a vacation. Moreover, in most cases, renters cannot choose a specific car model; they only book a specific class of cars. The time constraint and limited choice of car make it difficult for renters to form an emotional attachment to the car (Chapter 2).

7.2.3 Development over time

This dissertation derives four distinct use phases of the car: the familiarization phase, the everyday use phase, the optional malfunctions and defects phase, and the farewell phase (Chapter 2). Each phase is defined by its specific emotional characteristics. These findings support the results of Mugge et al. (2005), who demonstrated that the degree of product attachment changes over time as the relevance of the underlying determinants shifts.

Drawing upon Karapanos et al. (2009) concept of the orientation phase, this research identified the familiarization phase, which captures the user's initial experiences with the car. The retrospective (Chapter 2) and the cross-sectional inter-individual data (Chapter 3) show a large increase in emotional attachment during this phase. This corresponds with the results of Pettersson (2012), who emphasized the formative effect of the first impression on the development of emotional product attachment. Consistent with Karapanos et al. (2009) and Hassenzahl (2005), stimulating factors particularly influence emotional attachment, such as the novelty of the car and its innovative features.

Karapanos et al. (2009) subsequently describe the phases of incorporation and identification as separate segments, with emotional attachment only arising in the identification phase. However, the results of this dissertation indicate that these two phases cannot be clearly distinguished. Instead, the everyday use phase is identified, in which emotional attachment develops. A renewed increase in emotional attachment is observed among car owners after several years (Chapter 3). The findings indicate that as owners use the car for longer periods, they develop stronger memories

associated with it. This suggests that the shared history with the car is important and that the car becomes an emotional component of the user's life (Steg, 2005). However, lessees and car sharing users who use the car for a shorter period than owners also report collecting memories with the car and identifying with it. Thus, it is not assumed that the incorporation and identification phases should be considered sequential. Rather, they largely occur in parallel. Therefore, the research identified the everyday use phase, in which the novelty effect diminishes, habit sets in, and emotional attachment no longer increases as steeply or reaches a plateau. Nevertheless, through increasing experiences, evocation and identification can continue to rise, thus compensating for the declining stimulation.

In the malfunctions and defects phase, as soon as the car's actual functionality and, thus, its pragmatic qualities are reduced, emotional attachment also briefly declines (Chapter 2). This also supports the findings from Diefenbach (2012), according to whom pragmatic qualities can be considered as hygiene factors. According to Desmet (2002), in this case, there is a discrepancy between the user's concerns, such as getting from A to B, and the car's characteristics because it is broken.

Furthermore, this dissertation considers the farewell phase and shows that emotional ambivalence arises in the user during this phase. Negative emotions such as sadness predominate regarding the car that is to be returned (Chapters 2 and 4). The intensity of sadness can be seen as an indicator of the strength of the emotional attachment. This sadness arises from losing the presence of the memories associated with the car. This shows how strong memories are at this time, aligning with Hassenzahl's (2005) dimension of evocation. Identification is also strong, as evidenced by users comparing the farewell to the car with the death of a family member (Chapter 2). Owners with the strongest attachment to the car also show the greatest sadness, followed by lessees and car sharing users. At the same time, users are also looking forward to the upcoming car, as they often expect an upgrade, e.g., a car with less consumption, more power, better features, and/or larger size. This, in turn, primarily triggers stimulation through novelty.

Previous research, such as that of Karapanos et al. (2009), examined the time development only within a few weeks. Based on the results of this dissertation, it can

be assumed that the phases are longer due to the extended usage time of the car and can span several months to years.

7.2.4 Fostering of emotional attachments

The research demonstrates that it is possible to influence emotional attachments by specifically addressing hedonic dimensions (Hassenzahl, 2005) or the determinants of product attachment (Mugge, 2007), like memories or pleasure. Notably, this influence does not necessarily require a physical modification of the product itself. Rather, external triggers, such as the specially developed application, can evoke the desired emotional responses. Even users with a moderate emotional attachment are willing to use an application that specifically addresses the emotional aspects of the car (Chapter 6).

As the results show, the targeted stimulation of anticipation for an upcoming car significantly reduces the perceived sadness of parting with the previous car (Chapter 6). This finding underscores the importance of anticipation (Karapanos et al., 2009) as a crucial factor for product attachment. Furthermore, digitally storing memories of the previous car can help users ease the car change process. The digital preservation of the shared history with the car counteracts the feeling of loss and allows users to maintain the shared history with the car. However, this also strengthens the attachment to the car, thereby confirming the assumptions of Hassenzahl (2005), Mugge (2007), and Steg (2005). However, this can also make the farewell more difficult. Remarkably, the positive effects of anticipation and memory storage are independent of the users' pre-existing emotional attachment to their previous car (Chapter 6).

7.3 Practical implications

The dissertation generates practical insights that might be transferable to other durable goods in users' daily lives (e.g., mobile phones). Emotional attachments influence purchasing decisions, brand loyalty (Schau et al., 2009), and how consumers perceive and evaluate product attributes and performance, potentially leading emotionally attached consumers to overlook objective shortcomings (Belk, 1988). Furthermore, studying emotional attachments to cars has implications for urban planning and environmental policy. These attachments can shape driving behaviors

and the intention to use alternative transportation modes, impacting environmental issues and traffic jams (Steg, 2005).

A deep understanding of emotional attachments also has implications for the automotive industry, as it empowers manufacturers to craft products, services, and marketing strategies that better align with user needs and desires. Managing emotional attachments to the car is crucial for customer satisfaction, long-term customer retention, and brand loyalty. This requires considering the user experience throughout the entire automotive lifecycle, from the anticipation phase before usage to the end of ownership or car change. Automakers may aim not only to sell a car as a technical solution but also to foster a personal relationship between the user and their car. Automakers can build a deeper and more sustainable bond with their customers by creating experiences and memories tailored to the user's individual emotional needs. Therefore, the following recommendations are derived.

7.3.1 Foster stimulation

Anticipation and initial contact with the car help establish a positive emotional attachment. To achieve this, the automaker should reduce uncertainty and increase anticipation, which are key factors to be considered during this phase. New car customers can benefit from being involved in the car's production process and receiving regular status updates. The ability to track the progress of their car's production and delivery increases anticipation and builds an emotional attachment before they even receive the car (Chapter 6).

One option to reduce uncertainty is to explain car functions before handing over the car or during the initial drives. Manufacturers can give users a comprehensive overview of car functionalities through digital applications and targeted marketing strategies. This may be particularly relevant for car sharing users, who pay for car use per hour or minute and do not want to invest time learning how to use the car (Chapter 4). However, free-floating providers have the advantage that users can experience different cars each time, which could also increase stimulation.

As the car's novelty naturally diminishes over time, regular software updates for in-car features may be helpful to ensure continuous user stimulation. These updates refresh software and functionalities, which may sustain user interest and enthusiasm. For instance, manufacturers could gradually unlock new ambient lighting colors,

enhanced digital assistant configuration options, or innovative driver-assistance systems. Furthermore, they could implement seasonal or weather-dependent designs and functionalities to surprise users consistently. For example, they might offer specialized driving modes for snow and ice during winter or personalized climate control options during summer. Regular updates also contribute to car improvement over time, ensuring it adapts to users' evolving needs and desires. Finally, this cultivates the user's perception of the car as a dynamic and adaptable companion (Chapter 4).

7.3.2 Foster identification

Personalization and customization options may increase user identification with their car (Chapter 4). By creating a sense of ownership and personal space, automakers may build up a stronger emotional attachment between the user and the car. Therefore, offering ways to personalize a car should be possible throughout its entire lifecycle, from initial configuration to everyday use.

Car owners and lessees can customize their cars according to their preferences and needs. They choose colors, interior materials, and technical features to match their individual tastes. During the use of the car, they can bring personal items to enhance its unique character. However, automakers could work to emotionalize the configuration process itself by amplifying positive experiences associated with the car. Instead of merely listing features, they could tell stories illustrating how each function enriches the user's life. For instance, they could enhance the emotional appeal of a panoramic sunroof by presenting it not just as a technical feature, but as a chance for unforgettable stargazing drives with loved ones. This narrative approach directly connects specific functions to future experiences and emotions, potentially heightening the user's anticipation.

Especially when the initial novelty after the familiarization phase wears off, it is crucial to activate other hedonic aspects beyond stimulation for a positive emotional attachment, such as identification (Hassenzahl, 2006). The car could learn the user's preferences, recognize emotions, and react accordingly (Chapter 4) by integrating intelligent assist systems. For instance, the car could adjust the music volume or suggest taking a relaxing route when it detects that the user is stressed.

There is a noteworthy potential to increase identification, especially for car sharing users and renters. Greater freedom in car selection can lead to the user consciously choosing a car and being involved in the selection process. Furthermore, a personalized greeting by name and the storage of individual settings in a digital profile allow users to feel at home in the car (Chapter 4). This is particularly advantageous for station-based car sharing services because users can use the same car regularly. Repeated interactions with the same car can foster a stronger emotional attachment than with free-floating providers. However, as mentioned above, free-floating providers could increase stimulation. Therefore, car sharing providers should carefully consider which business model aligns with their strategic goals and the associated emotional consequences.

Car sharing users identify not only with the car itself but also with the concept of sharing (Chapters 2 and 3). Car sharing users prioritize managing their daily lives without owning a car while maintaining a sustainable and socially responsible lifestyle. Marketing strategies that specifically address these aspects can foster this feeling. Additionally, developing gamification elements, such as visualizing the CO2 emissions currently saved, could make the positive contribution to environmental protection more tangible and motivate the user. Thus, emphasizing social aspects is crucial to foster identification, especially among car sharing users (Chapter 4).

Identification can also be increased by creating a community and thus strengthening the sense of belonging (Chapter 4). Social platforms allow users to exchange information about their experiences, interests, customizations, and other car-related topics. This encourages sharing information and tips and enables users to feel like part of a community. This community shares their passion, leading them to identify more strongly with the car and the brand, which also may strengthen loyalty. Furthermore, the community provides valuable feedback for manufacturers, enabling them to better understand their customers' needs and desires and incorporate them into future developments.

7.3.3 Foster evocation

According to the results of this research, integrating functions that support generating and storing lasting memories and experiences strengthens the car’s ability to elicit

memories. Storing photos, vacation memories, and car driving statistics allow users to build a personal connection to the car (Chapter 4).

For technical realization, images from the car's interior and exterior cameras can be used to generate videos that capture the best moments of the journey with the help of artificial intelligence. Owners and lessees who have used the car for several years can particularly benefit from these functions. However, capturing memories may also make parting with the car more difficult, leading to extended usage periods (Chapter 6). Although this is desirable from a sustainability and reduced consumption perspective, it can be undesirable from an economic point of view for the automakers.

Nevertheless, evocation is a relevant component of emotional attachment and can strengthen brand loyalty. Therefore, automakers could increasingly focus their marketing on shared experiences that the car enables and the memories that arise from them. Telling shared stories that place the car as a central companion and supporter may create a common narrative and a strong emotional resonance.

Furthermore, cars could proactively suggest shared experiences like road trips to special regional attractions. This would stimulate the creation of unique memories. Integrated recommendations based on the user's individual preferences and interests may further strengthen evocation.

7.4 Strengths and limitations

The present dissertation has notable strengths and limitations, which are discussed in detail in this chapter.

One strength is the contribution to research in the field of emotions and emotional product attachment in the automotive context. This approach validates theoretical assumptions and findings from other product areas and identifies specific emotional peculiarities in the context of cars. Previous research acknowledges cars have an emotional meaning beyond their practical function for many users (e.g., Eckholdt et al., 2013; Hassenzahl, 2018; Steg, 2005). Nevertheless, comprehensive empirical studies addressing emotional attachments to cars have been lacking. The dissertation addresses this research gap by systematically investigating emotional attachment to cars. These results provide approaches for future research.

The dissertation also contributes to the question of how emotional attachments to cars change over time. Previous studies have often examined emotions or the degree of an emotional attachment at a single moment or over rather short periods (e.g., Karapanos, 2009). This research considers the entire usage period and goes beyond this by considering the anticipation before receiving the car and memories after parting with the car. It identifies distinct use phases, each with its own emotional characteristics. Of particular note is the focus on the car change, when users part with their cars and anticipate the upcoming car. Focusing on this phase represents a novel contribution, as it has been largely neglected in former research.

The dissertation, moreover, explores how emotional attachments to products can be deliberately influenced. Different app variants were developed and evaluated based on psychological determinants of product attachment. Even though these app variants were tested separately to assess their individual effects, it is possible to seamlessly integrate these variants into one offer as a holistic concept. As former research has rarely explored practical strategies to strengthen these attachments, this work provides additional insights into how to implement such strategies.

Furthermore, this dissertation derives practicable recommendations for the automotive industry, as shown in Chapter 7.3. By strategically addressing emotions, manufacturers can foster long-lasting positive user experiences (Thüring & Mahlke, 2007). This leads to an emotional attachment which is reflected in increased customer satisfaction and loyalty (Schau et al., 2009; Thüring & Mahlke, 2007). Recommendations are given to enhance the hedonic aspects, thus strengthening the emotional attachment to the car.

A methodological strength of this dissertation is its mixed-methods approach. A comprehensive method set was developed to investigate emotions towards the car and emotional attachment. This set consists of various quantitative and qualitative methods, such as the Product Emotion Measurement Instrument (PrEmo2; Laurans & Desmet, 2017) and the Product Attachment Scale (PAS; Mugge et al., 2005). These methods were employed within individual studies and across multiple studies. This ensured a comprehensive and multifaceted examination of the research topic. The combination of different methods within each study enables in-depth explorations to uncover underlying reasons and connections and confirmatory, comparative analyses to test hypotheses quantitatively. Another advantage of the developed methodological

approach is its flexibility. It could be reused in various studies and adapted to the research question. Furthermore, this dissertation contributes to establishing the UX Curve (Kujala et al., 2011) as a longitudinal retrospective approach for assessing the development of emotional product attachment. This method set is not limited to this dissertation but has already found application in other areas of the automotive industry, e.g., in understanding the emotional attachment to digital assistants.

The research also benefits from its objectivity, which was ensured through the involvement of additional researchers in every study. This included feedback on the study design and guidelines. Furthermore, a second researcher independently conducted the qualitative data analysis, subsequently discussing areas of agreement and divergence to derive an interpretation based on a shared coding framework (Chapters 2, 4, and 6). Moreover, external, trained moderators were employed for the studies in Chapters 2 and 4 to minimize any influence by the researchers.

Despite the dissertation's strengths, certain limitations are considered:

- The recruiting criteria for participants vary across the different studies. The study in Chapter 2 focuses on users with emotional attachment and station-based car sharing. In contrast, the studies in Chapter 3 have no specific pre-selection and include users of free-floating car sharing. This is necessary due to the specific research objectives of the studies in each chapter but may limit the comparability of the results between them.
- The studies were exclusively conducted in Germany, which restricts the generalizability of the findings (Chapters 2, 3, 4, and 6). The emotional meaning attributed to cars may differ from other cultural contexts.
- The pre-defined nature of the user groups precludes a fully experimental setting, thereby limiting causal inferences and impacting internal validity (Chapters 2, 3, 4, and 6). Several measures were implemented according to Westermann (2016) to mitigate this limitation and maximize internal validity: The app variants were presented in a randomized way to prevent order effects (Chapter 6), a control condition was incorporated within the app variations (Chapter 6), and a standardized guideline was used across all studies. Furthermore, participants were unaware that different user groups were being investigated (Chapters 2, 3, 4, and 6).

- Participants were asked to imagine themselves in specific situations, such as saying farewell to their car. While hypothetical scenarios are a common research method, this setting could potentially introduce some bias (Kaderabek & Sinibaldi, 2022). To minimize this bias, the selected participants in Chapter 6 had either recently changed cars or planned to do so in the coming months.
- Certain phases, such as the farewell phase, could not be captured neither in the UX curve nor in the cross-sectional design because participants were still using their cars at the time of data gathering (Chapters 2 and 3). Therefore, it had to be explored by open questions.
- Similarly, malfunctions could not be investigated with quantitative data in Chapter 3. These events are typically brief compared to overall usage and participants were not asked about acute malfunctions or defects in their cars. Therefore, lower scores in emotional attachment could not be associated with malfunctions or defects (Chapter 3).
- As the PAS questionnaire was adapted to the automotive context, the chosen reference groups for assessing group affiliation (owners, lessees) may be inappropriate (Chapters 2, 3, and 6). Owners and lessees might identify more strongly with brand or model affiliation than with the ownership status. For instance, an owner or lessee might feel a stronger sense of belonging to the group of "Audi users" rather than "owners" or "lessees".

7.5 Future research

This research’s insights may be helpful for future studies to delve even deeper into the complexities of emotional car attachment.

Future research should consider different testing designs. Longitudinal studies could be beneficial for a better understanding of the dynamics of emotional attachment. These investigations should cover the entire car’s usage period, capturing emotions and attachment as they are experienced in different use phases, including the car change process.

The effectiveness of the app designed to foster attachment needs to be studied longitudinally to uncover long-term effects on product attachment.

Field studies with users actively experiencing the relevant use phases would eliminate the hypothetical element of previous approaches.

Future research should investigate the characteristics of the users and the cars in more detail. Therefore, socioeconomic factors should be considered. Individuals with lower incomes may save longer for a non-premium, older car, whereas higher-income individuals purchase newer, premium cars. This difference could impact the subjective value of the car and, consequently, the emotional attachment.

To gain a more nuanced impression, future studies should go beyond the premium/volume distinction based on the brand and consider further car characteristics such as year of manufacturing or specific models to differentiate between car classes. For example, a new, large car from a volume brand can be more prestigious than an old, small model from a premium brand. This can lead to various levels of identification and thus a different emotional attachment. Furthermore, the brand itself can influence emotional attachment. Therefore, future research should investigate the distinct customer segments targeted by various brands and their specific emotional needs to enable more targeted and differentiated brand-specific engagement strategies.

Emotional attachment should be investigated in other countries to verify the cross-cultural validity of the findings in Germany and facilitate intercultural comparisons. The emotional meaning of the car probably differs in other cultures.

A mixed-methods approach, combining qualitative and quantitative techniques, is recommended to explore the needs and nuances of emotional attachments to cars. However, quantitative validation with larger sample sizes is also necessary to ensure the robustness and generalizability of the findings. Therefore, future research should strategically integrate qualitative methods for in-depth exploration of motivations and emotional experiences, followed by quantitative studies with larger, diverse samples to statistically test emerging hypotheses and ensure the broader applicability of the findings.

The methodological toolkit for studying emotional car attachment needs to be further refined and systematically validated. Developing and validating context-specific instruments may also be necessary to capture the dynamic nature of emotional car attachment comprehensively. Investigating whether users identify more strongly with brand, model, or other affiliations (beyond owner/lessee) is critical to measuring group

affiliation accurately. Adapting the PAS to the automotive context requires reconsidering relevant reference groups thoroughly.

Further research should explore additional strategies to influence emotional attachment. These strategies should also address self-expression and group affiliation to encompass all determinants of product attachment and ensure broad applicability. While the findings regarding the app developed in this dissertation suggest its potential relevance beyond the car change phase, future strategies should take a wider perspective and consider the entire usage period of the car.

Finally, subsequent studies should examine the potential for applying the insights found to other product categories (e.g., consumer electronics products or fashion). This could increase the period of use, facilitate exceptional user experiences, and foster long-term customer loyalty.

8. Conclusion

"Is it weird to love your car?" (gutefrage, 2022)

The starting point of this research were the experiences shared in online forums – of happiness at the sight of one's first car or of tears shed when parting with a beloved "20-year-old Clio" (gutefrage, 2012), and the deep connection that led some to risk breaking up with a partner rather than with their car. This dissertation demonstrates that these experiences are not isolated incidents. It explores the emotional attachment between individuals and their cars, confirming existing literature in other product domains and expanding the understanding of how cars transcend mere functionality to evoke emotional responses. The findings demonstrate that cars are not simply status symbols or technical objects. Instead, they represent aspects of identity deeply rooted in users' life stories through associated memories with the car and the car's ability to stimulate the user. These attachments can manifest as pride, nostalgia, or even grief, profoundly influencing human development and how users construct their social identities.

Qualitative and quantitative analyses show that different user groups - owners, lessees, car sharing users, and renters - exhibit varying degrees of emotional attachment to their cars. These differences highlight that the determinants of product attachment and the role of hedonic qualities vary in individual user experiences. Another key finding is that distinct use phases were identified, each characterized by specific emotional patterns. These insights offer new perspectives for understanding emotional attachment in the automotive sector and demonstrate that the attachment to a car must be viewed within a dynamic and context-dependent framework.

However, this dissertation contributes to the field by developing and testing concepts for strategically influencing emotional attachment, especially during car changes. These practical approaches offer new ways for marketing strategies and customer interactions in the automotive industry that extend far beyond simply presenting products. In summary, emotional attachment to a car is influenced by diverse factors. This dissertation lays the foundation for future research and provides the automotive industry with tools to understand and respond to their customers' emotional needs.

Furthermore, the dissertation gives the authors in online forums—and all those who see their car as more than just transportation—the first scientifically founded and tested approaches to making the emotional process of changing cars more convenient and supportive. Loving a car might seem unusual for some users at first glance. However, by exploring the depths of emotional attachment, this dissertation has revealed that it is profoundly human.

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Appendix

Appendix A. Interview Guideline (Chapter 2)

Topic	Instruction
I. Introduction	1. Please introduce yourself 2. Which car (model, type) do you own/ lease/ use / rent? 3. How long do you already own/ lease / use the car? 4. a) *Owner and leasing:* How long are you planning do own/ lease the car? b) *Car sharing and renting:* How often do you use the car? 5. For which reasons do you use the car?
II. Self-Assessment Manikin Scale	6. Now we would like to delve a bit deeper into your relationship with the car and the emotions associated with it. I will now show you five pictures, each depicting a different positive facial expression. The first picture shows a sad person, and the last picture shows a happy person. Please select the number on the scale where you see yourself when you think about your car. 7. Next, I will show you five more pictures, each depicting these feelings with different intensities. The first person is very calm, almost asleep. The last person is full of energy. Please select the picture that best represents the intensity of your feelings.
III. Product Emotion Measurement Instrument	8. Next, I will show you pictures depicting various emotions. Please take a close look at the following images. When you think about your car, which emotions best describe how you feel? a) Where does each feeling come from? Origin, cause? b) How does each feeling express itself?
IV. Open questions	9. What makes the car so special to you? a) How did you choose the car? What criteria did you use? b) Is this car perhaps your first new car? c) Is this the car that first had certain features? d) Is this the car with which you associate a special experience or experiences?" 10. What distinguishes this car from your other or previous cars? 11. Have you ever had a car (or was there one in your family) that you found more amazing than the one being considered here? a) What is the reason for this? b) How could you tell? 12. Do you know anyone who is more emotionally attached to their car(s)? (if no: who is less emotionally attached to their car?) a) How can you tell? b) What is the difference between your acquaintances and yourself?
V. Product attachment scale	13. Next, you will receive a questionnaire that you can fill out on your own. I will hand over control to you for this. Please answer the following questions by selecting a response on a

	scale from 1 = strongly disagree to 7 = strongly agree. Don't think too long about your answers. There are no right or wrong answers
VI. Inclusion of other in the self scale	14. Please select the picture that best describes your current relationship with your car. (X = car)
VII. UX Curve	15. Now we come to the part where we discuss the timeline and development of your relationship with the car. For this, I will show you a coordinate system in which you can draw independently. Please remember the moment when you first came into contact with your car (this can also be the waiting period). Please draw a curve and describe how your relationship with the car has changed from that point until today. Please add relevant emotions to your curve and reasons for changes. Think aloud during drawing
VIII. Farewell	16. Finally, we come to the end of the relationship. a) In your view, when is the end of the relationship with your car reached? b) What emotions play(ed) a role when thinking about or experiencing the separation from your car? c) What could help you overcome these feelings?

Appendix B. Assignment of brands to car classes (Chapter 3)

The following presents the classification of brands used by participants in our studies into premium and volume brands. This assignment was based on the definition of Dudenhöffer (2014) and align with Autohaus (2024), Munoz (2023), Pankow (2018), Premiummarke (2024), and Rosengarten and Stürmer (2004).

- Car brands considered as premium brands: Artega, Aston Martin, Audi, Bentley, BMW, Ferrari, Lamborghini, Lexus, Mercedes, MINI, Porsche, Smart, Tesla, Volvo
- Car brands considered as volume brands: Alpha Romeo, Aiways, Chevrolet, Chrysler, Citroën, Cupra, Dacia, Fiat, Ford, Honda, Hyundai, Jeep, Kia, Mazda, Mitsubishi, Nissan, Opel, Peugot, Polestar, Renault, Seat, Skoda, Suzuki, Toyota, Volkswagen

Appendix C. Questionnaire ideas evaluation (Chapter 5)

The following questionnaire is designed according to the model of Kano et al. (1984)

IDEAS EVALUATION - CAR CHANGE

Imagine you are the owner of a car that you have owned for many years and that has played an important role in your life. It was your first car that you bought after years of saving, or it was a gift from someone very close to you. Perhaps you created many unforgettable memories with it, such as road trips with friends or romantic getaways with your partner.

However, it is now time for a change of vehicle, as your old car has aged and become prone to repairs. You know it's time to buy a new car, but you feel uncomfortable at the thought of giving up the old one. You have developed a strong emotional attachment to this car, and it almost feels like losing a good friend.

The following are ideas presented to help you emotionally during the vehicle change. First, we will ask how you would feel if this idea was present, followed by how you would feel if this idea was absent. There is no right or wrong answer. Please try to answer as spontaneously as possible without thinking too much about it.

1. Postcards

Imagine you would receive updates from your previous car after parting with it, like postcards. Where is it now, what is going on,…?

a) If there ARE postcards of your previous car, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

b) If there are NO postcards of your previous car, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

2. Travel parameters (numbers, data, facts)

Imagine you could access small statistics about past vacation trips in an app. For example, how many kilometers you drove, average speed, music you listened to, fuel consumption, etc.

c) If there ARE parameters (numbers, data, facts) about vacation trips, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

d) If there are NO parameters (numbers, data, facts) about vacation trips, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

3. Heatmap

Imagine being able to view your past (vacation) trips on a map within an app. You can see the routes you've taken with your car displayed as a heatmap.

a) If there IS a heatmap, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

b) If there is NO heatmap, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

4. Photo album

Imagine that upon giving away your old car, you receive a digital photo album that you can also view in your new car. This photo album contains highlights of your time together, moments you shared, trips you took together.

a) If there IS a photo album, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

b) If there is NO photo album, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

5. Today in the past

Imagine regularly receiving push notifications with pictures from the past, like Google Photos "Today in the past" feature.

c) If there ARE regular notifications, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

d) If there are NO regular notifications, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

6. Statistics and records

Imagine you can see statistics and records you have achieved with your past cars (e.g., most kilometers driven on one day, highest point, longest night drive,…)

e) If there IS an overview with statistics and records of past cars, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

f) If there is NO overview with statistics and records of past cars, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

7. Real-time tracking

Imagine you can track the production process of your upcoming car, like shipment tracking for packages.

g) If there IS a real-time tracking, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

h) If there is NO real-time tracking, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

8. Live images from production

Imagine you could watch live at various manufacturing stages of your new car in an app.

a) If there IS a possibility to see live images from production, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

b) If there is NO possibility to see live images from production, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

9. Explanation of new functions

Imagine you could already read about the new function in your upcoming car before receiving it.

c) If there ARE explanations of new functions, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

d) If there are NO explanations of new functions, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

10. Video clips

Imagine you could watch short video clips about your upcoming car before receiving it.

e) If there ARE video clips about the upcoming car, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

f) If there are NO video clips about the upcoming car, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

11. Gaming

Imagine you could already use a virtual model of your upcoming car for video games.

g) If there IS the possibility to use a virtual car model in video games, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

h) If there is NO possibility to use a virtual car model in video games, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

12. 3D Model (exterior)

Imagine you could see the most accurate 3D model of your past and current cars, including your wheels, stickers, and other modifications.

a) If there IS a personalized 3D model, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

b) If there is NO personalized 3D model, how do you feel …

I like it	I expect it	I am neutral	I can live with it	I dislike it

13. 3D model with interior view

Imagine you could also see the interior of your cars in the 3D model.

a) If there IS a 3D model with an interior view, how do you feel?

I like it	I expect it	I am neutral	I can live with it	I dislike it

b) If there is NO 3D model with an interior view, how do you feel …

I like it	I expect it	I am neutral	I can live with it	I dislike it

Do you have any additional comments?

Thank you ☺

Appendix D. Prototype (Chapter 5)

D.1 Variant 'Memories'

Figure D.1-1

Start page with different tiles of the 'Memories' variant (same for the 'Pragmatic' variant)

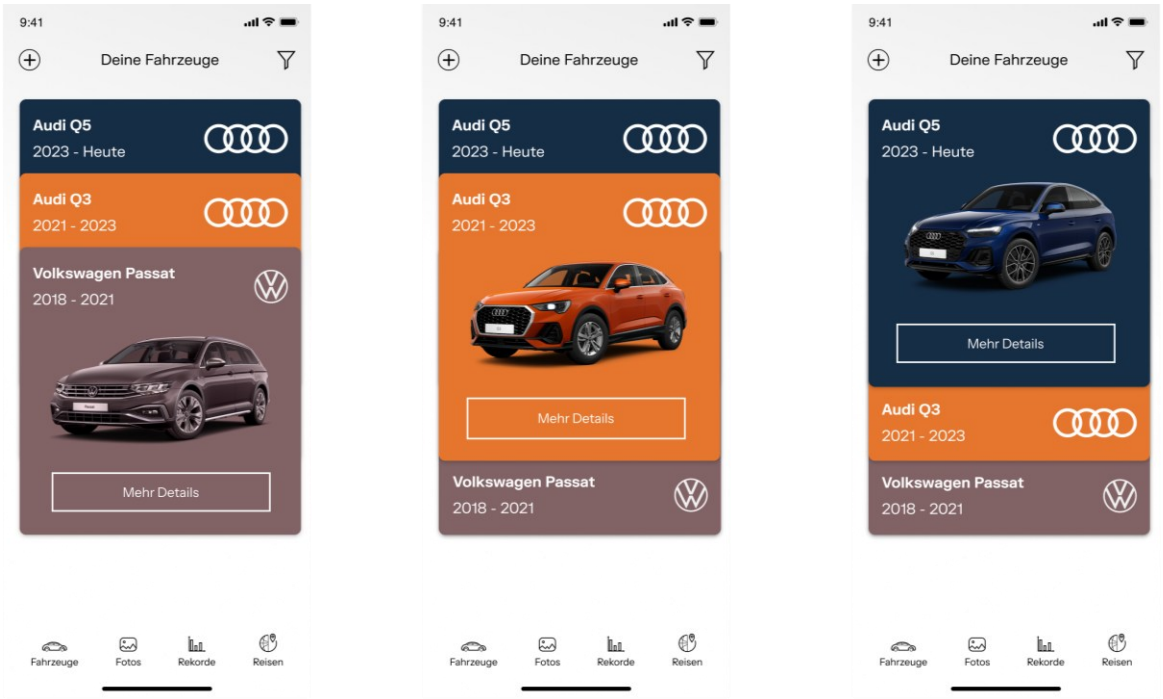
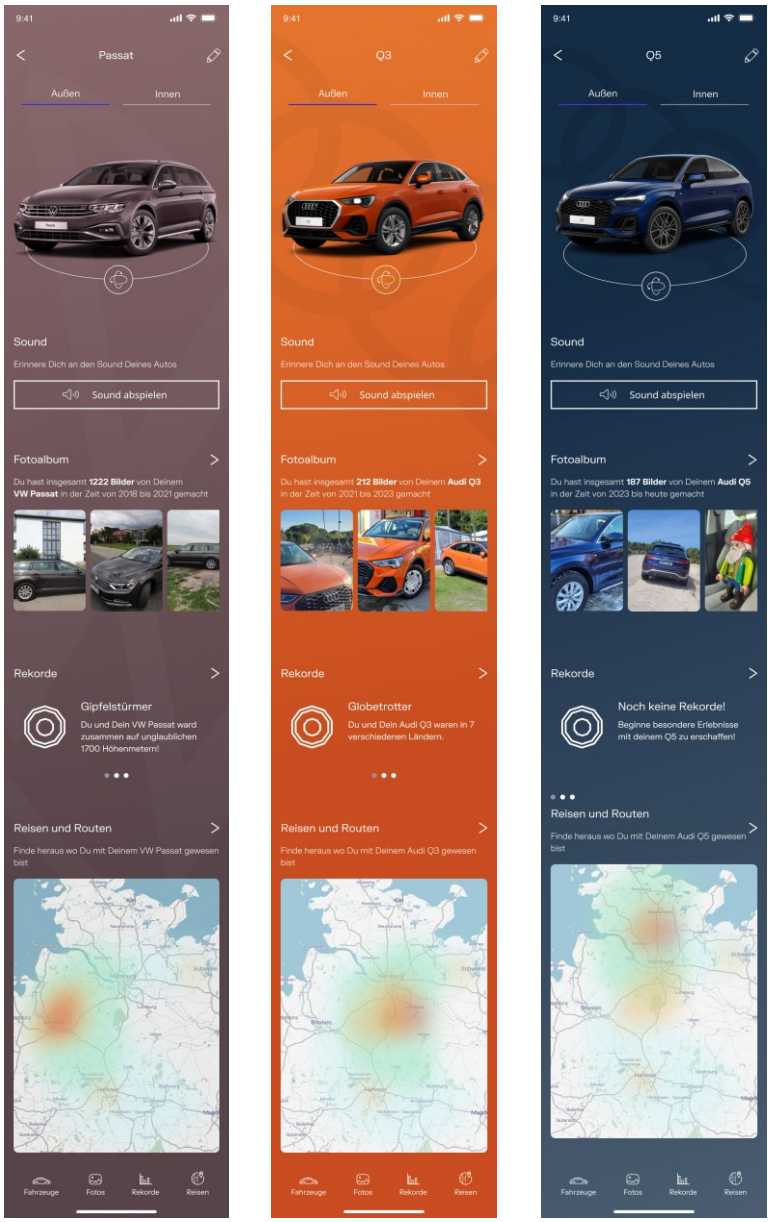


Figure D.1-2

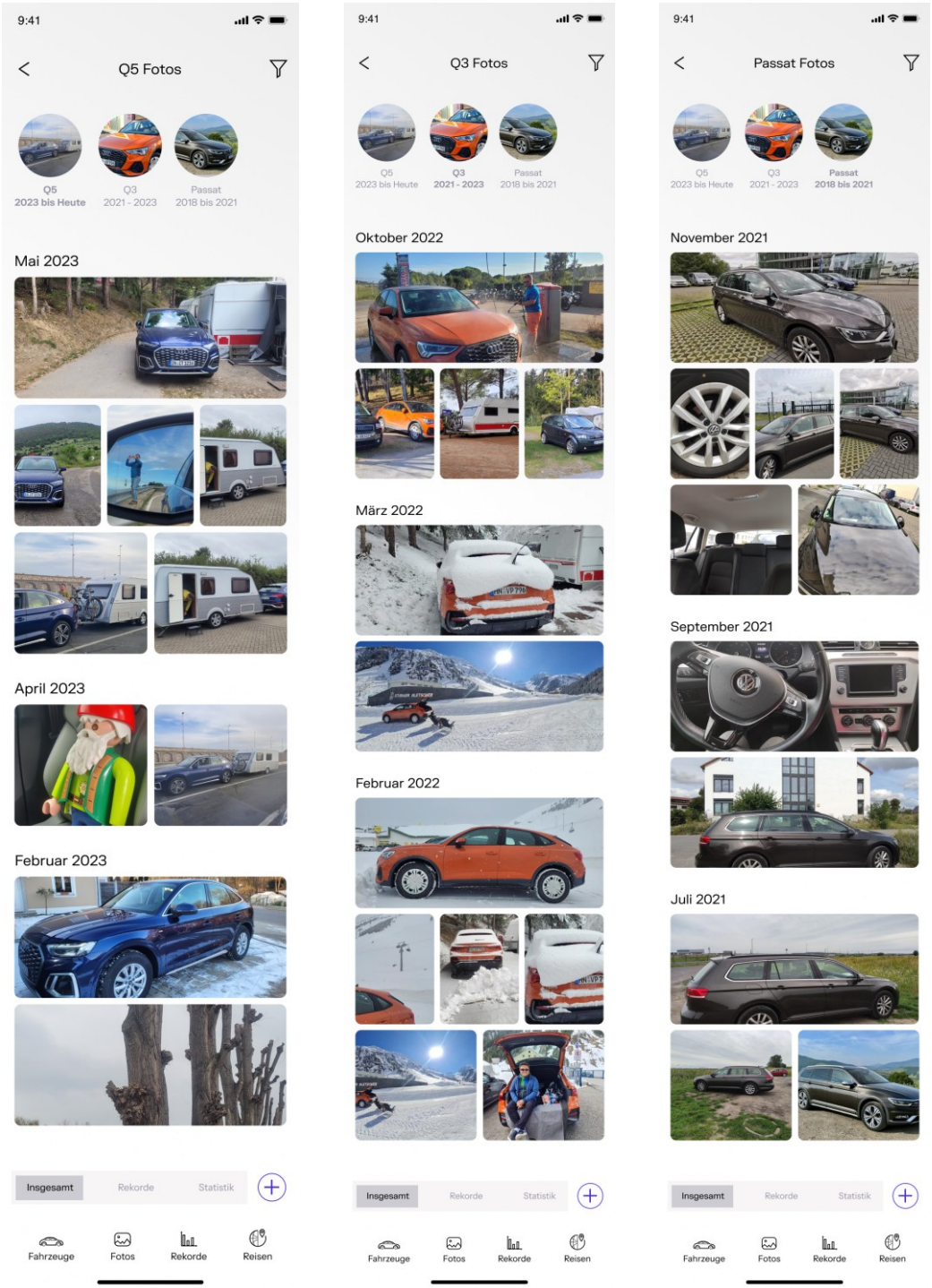
Overview pages of the respective cars in the 'Memories' variant



Note. Above, you'll find a 3D model of the car, offering a complete 360-degree view of both its interior and exterior. Below this, the specific features of the 'Memories' Variant for the selected model are displayed. These include the photo album, records and statistics, and journeys and routes. Users can access these features with a simple click.

Figure D.1-3

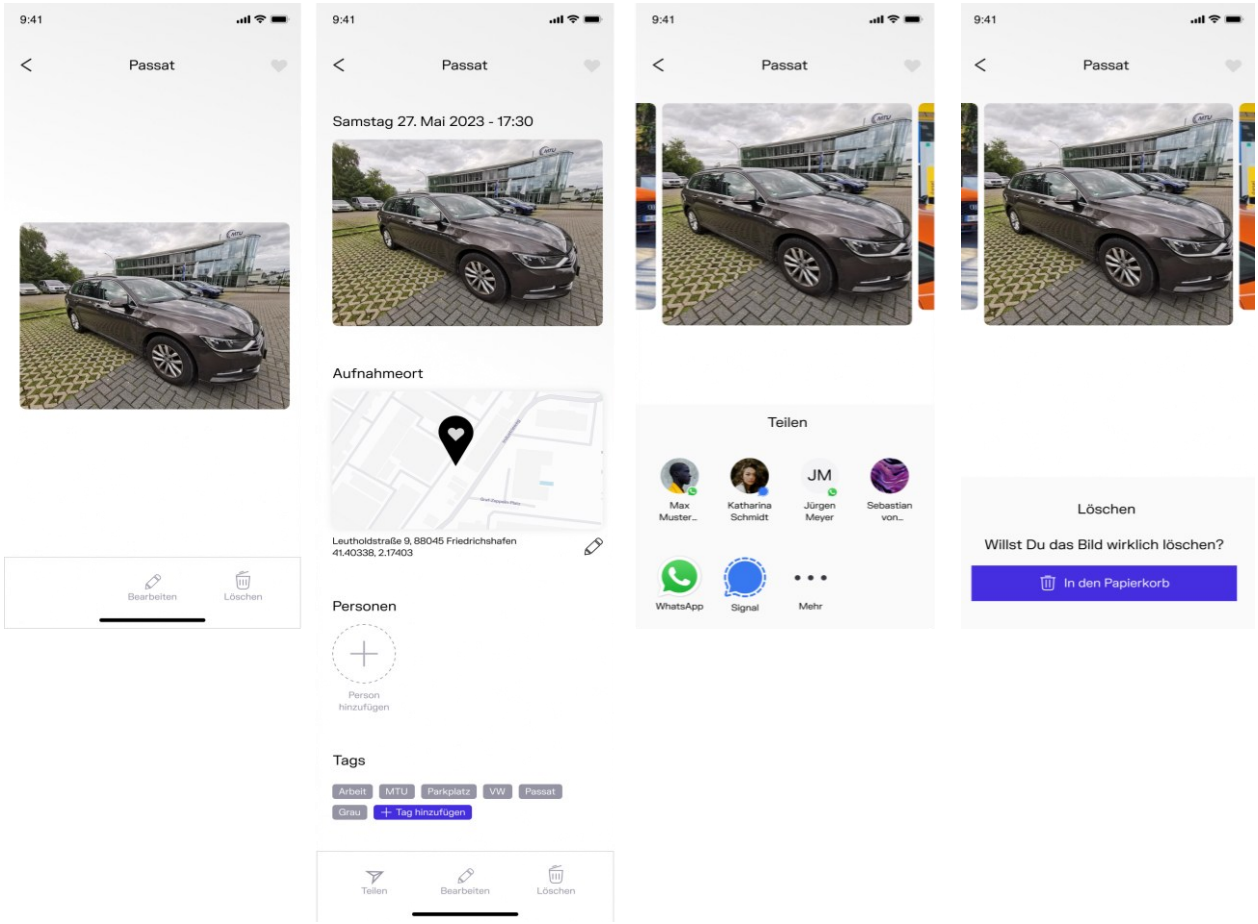
First page of the feature photo album in the 'Memories' variant



Note. Above, filtering options allowed users to view photos of a specific car.

Figure D.1-4

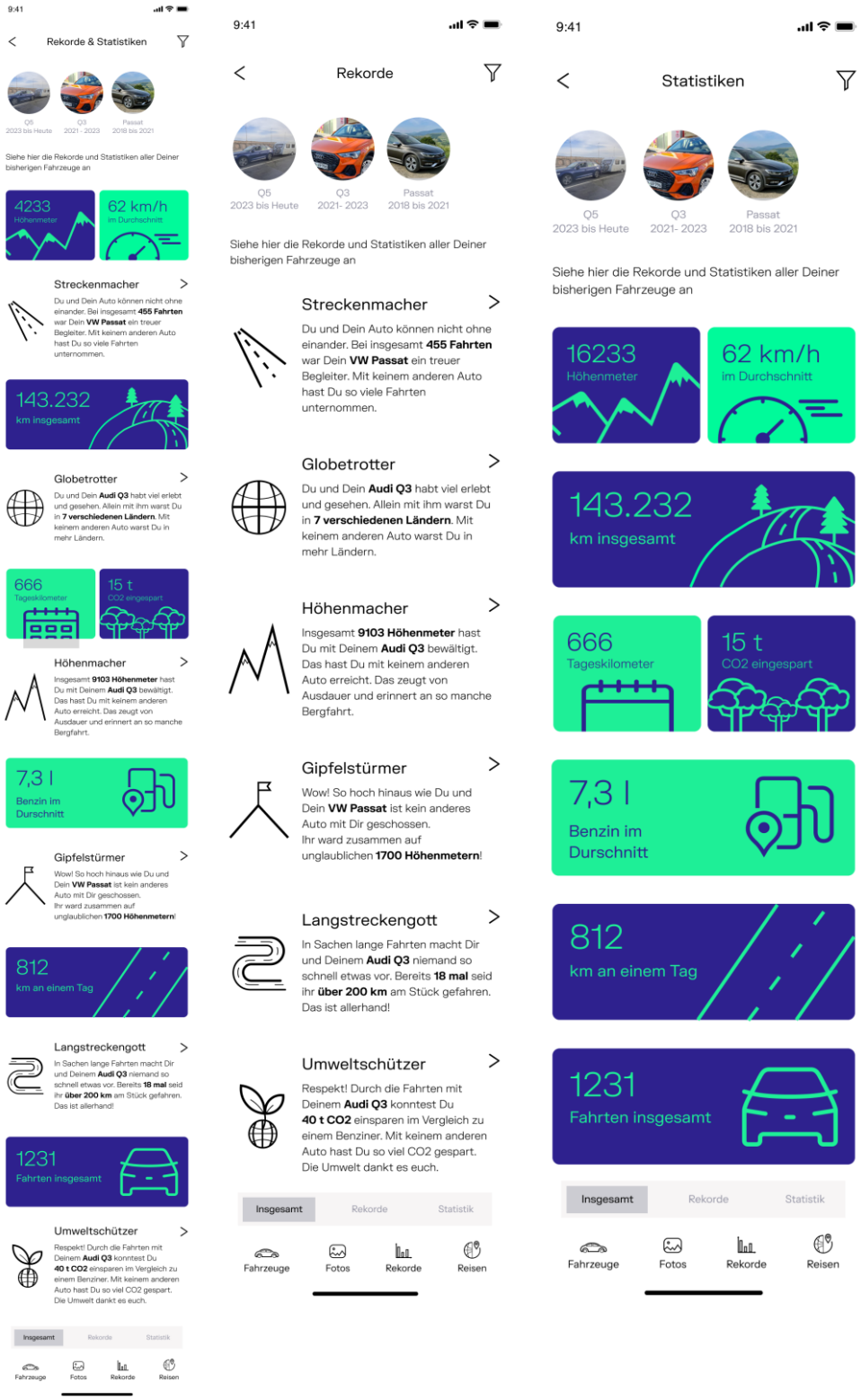
Single photo view options within the photo album of the 'Memories' variant



Note. When viewing a single photograph, the following options are available: edit or delete (left), access date and location metadata, tag individuals, and view AI-generated tags (second from left, via double-click), share via social media (third from left), and delete (right).

Figure D.1-5

Records and statistics feature of the 'Memories' variant



Note. These records and statistics pages provide a comprehensive overview of all statistics and records across all previous and current cars (left), all records across all cars (middle), and all statistics among all cars (right)

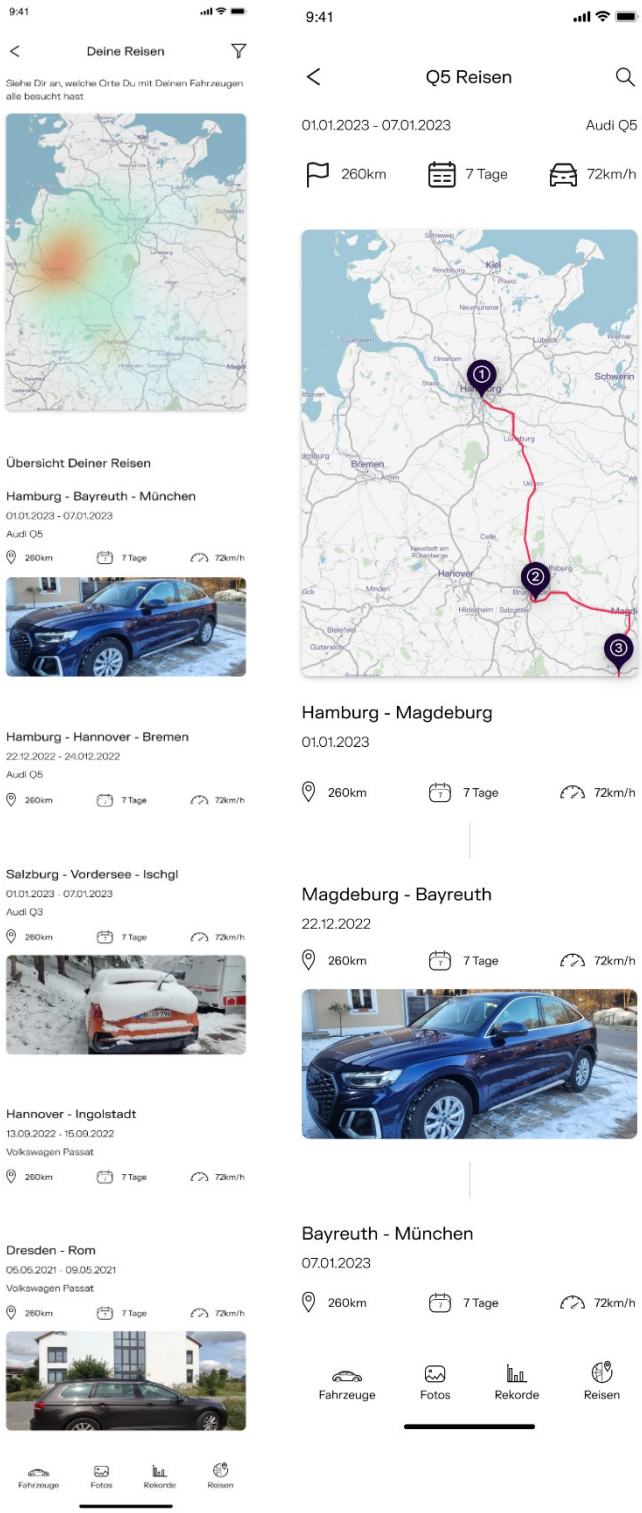
Figure D.1-6

Overview of all statistics and records of one specific car (left) and detailed information about one record (in this case: Globetrotter, right)

Note. Double-clicking on any statistic or record provides access to further details.

Figure D.1-7

Overview of the travel feature (left) and detailed information about a specific trip (right)



Note. The left side features a heatmap and an overview of all past vacation trips. On the right, you can find detailed information about a selected trip, including the itinerary, individual stages, and related photos.

D.2 Variant 'Pleasure'

Figure D.2-1

Start page with different tiles of the 'Pleasure' variant including the tile for the upcoming car

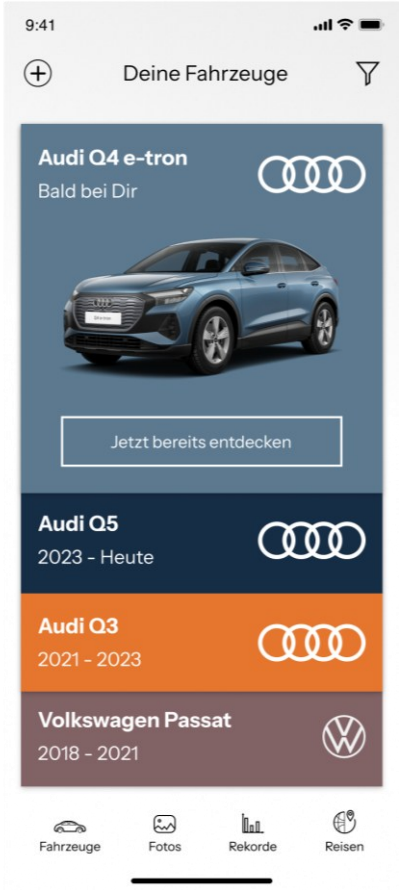


Figure D.2-2

Overview page of the upcoming car

Note. Above, the 3D model of the car is presented, offering a complete 360-degree view of both its interior and exterior. Below this, the specific features of the 'Pleasure' variant for the upcoming car are displayed. These include live tracking, including the live image, short video clips, and explanations of new features of the car. Users can access these features with a simple click.

Figure D.2-3

First page of the live tracking and live image feature of the 'Pleasure' variant

Note. The car's completed production steps are shown in chronological order. A link to the live image will appear in the top right corner when available.

Figure D.2-4

First page of short video clips in the 'Pleasure' variant

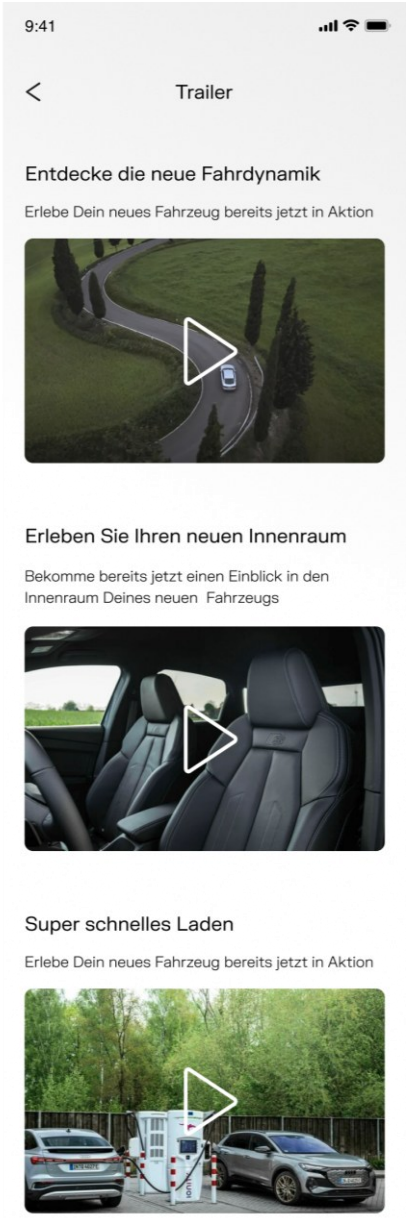
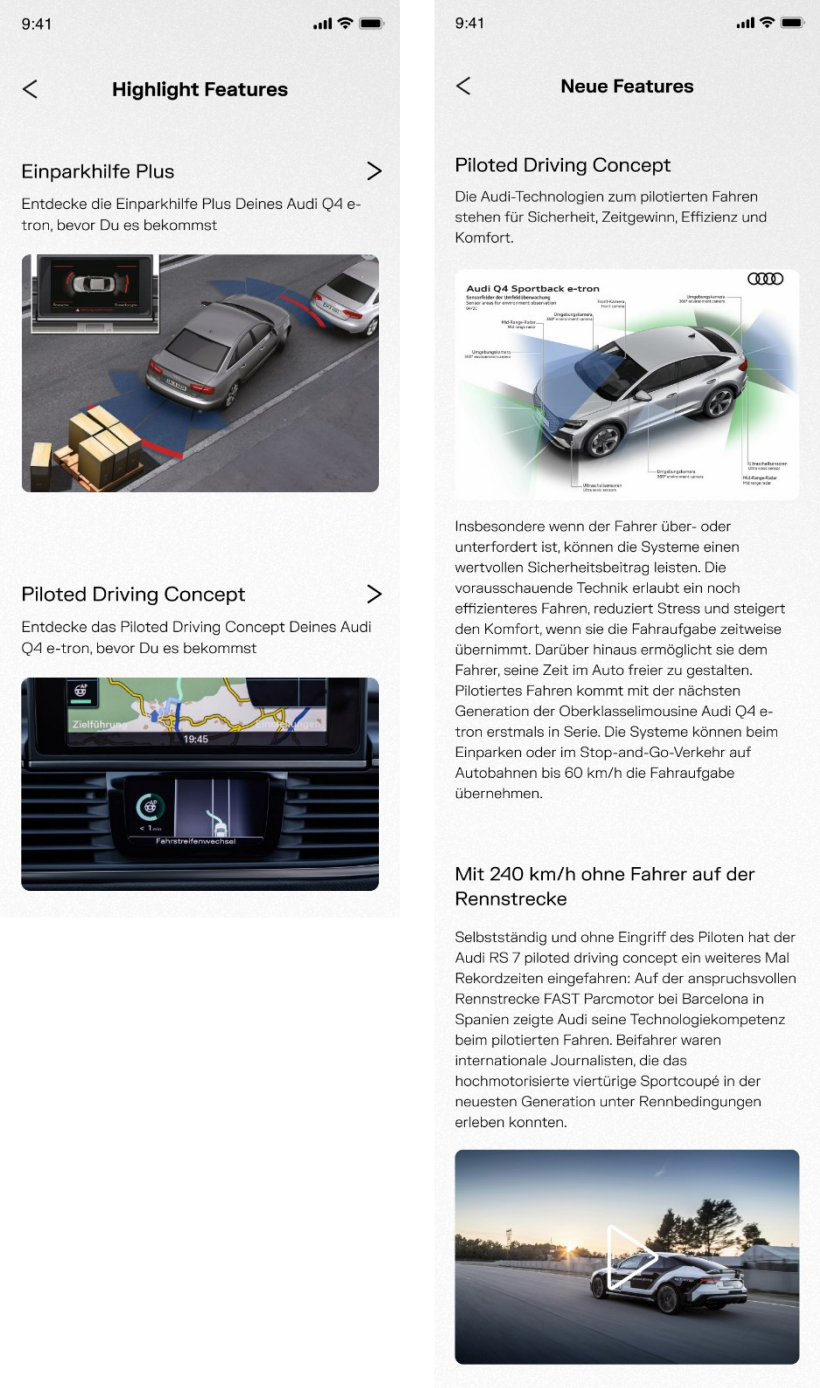


Figure D.2-5

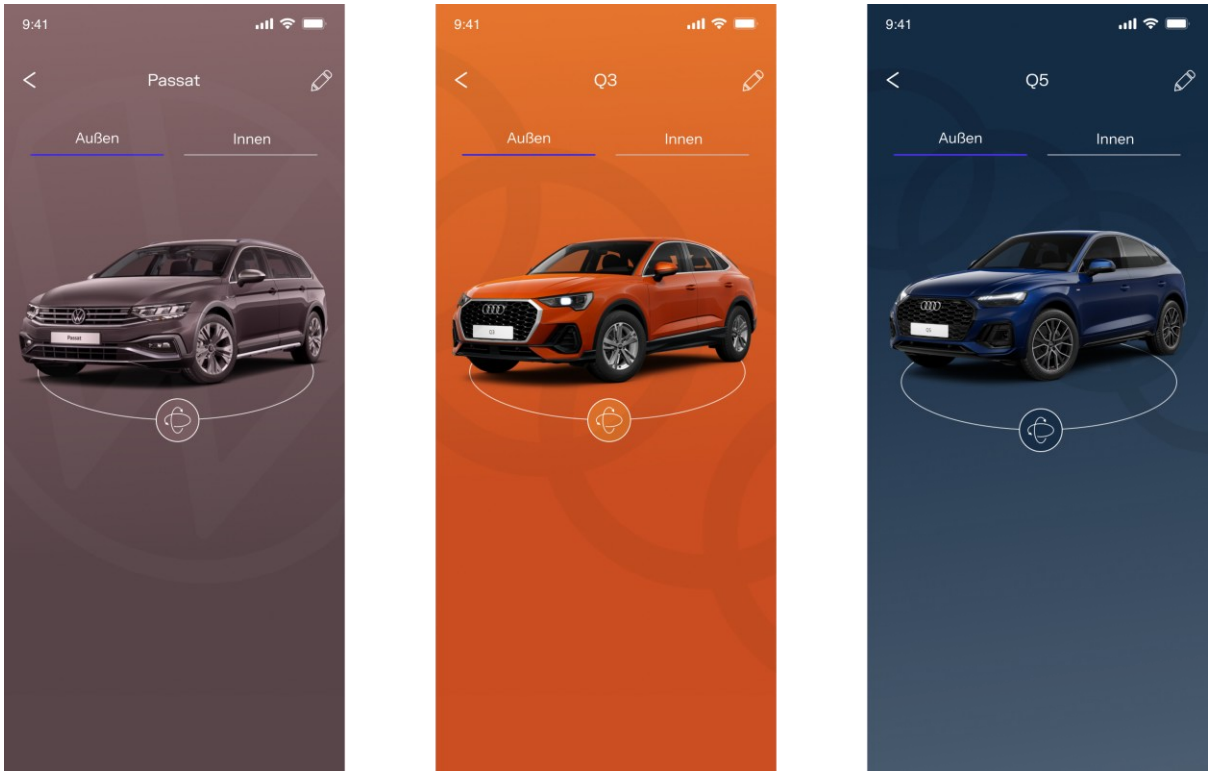
First page of the explanations of the new car's features of the 'Pleasure' variant (left) and further detailed information about one chosen feature (right)



Note. The first page provides an overview of all new features of the upcoming car. By clicking, the user can access further information and explanations about the selected feature

Figure D.2-6

Overview pages of the past cars and the current car of the 'Pleasure' variant



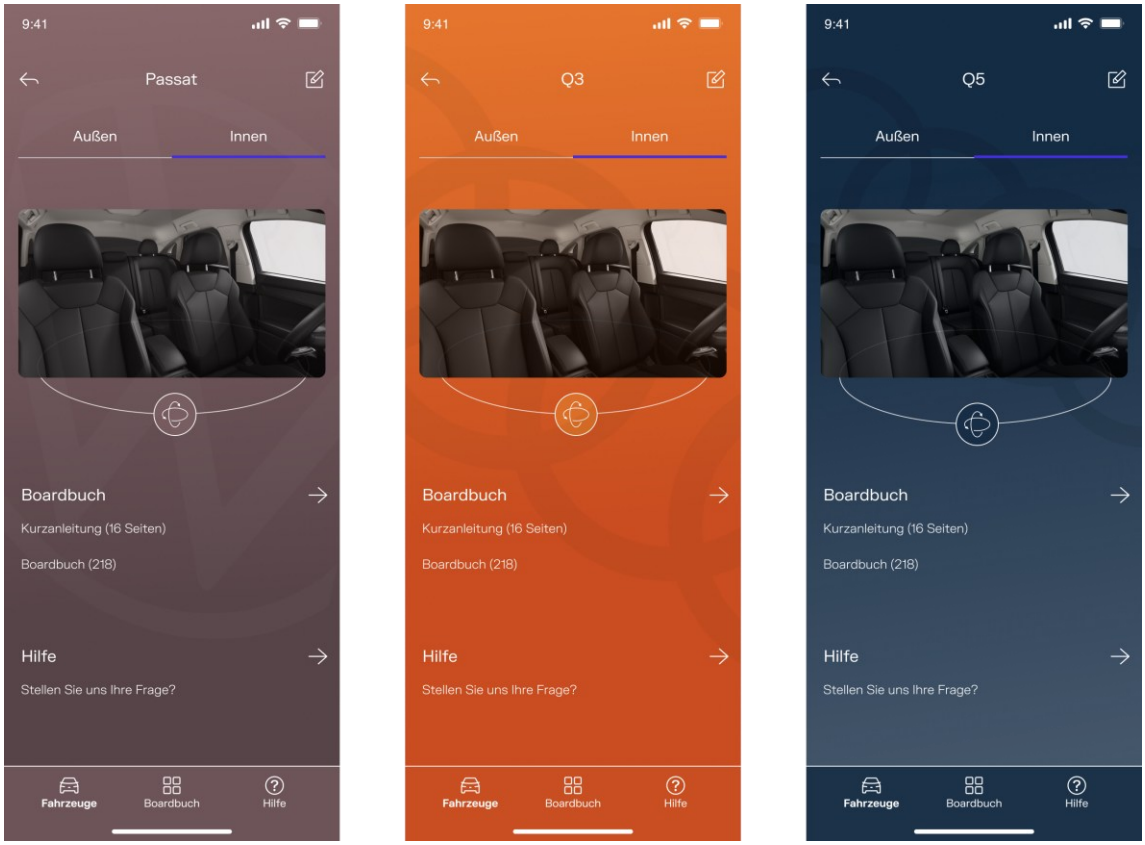
Note. In the 'Pleasure' variant, just the 3D models of the respective cars were displayed

D.3 Variant 'Pragmatic'

For the start page of the 'Pragmatic' variant, see Figure D.1-1

Figure D.3-1

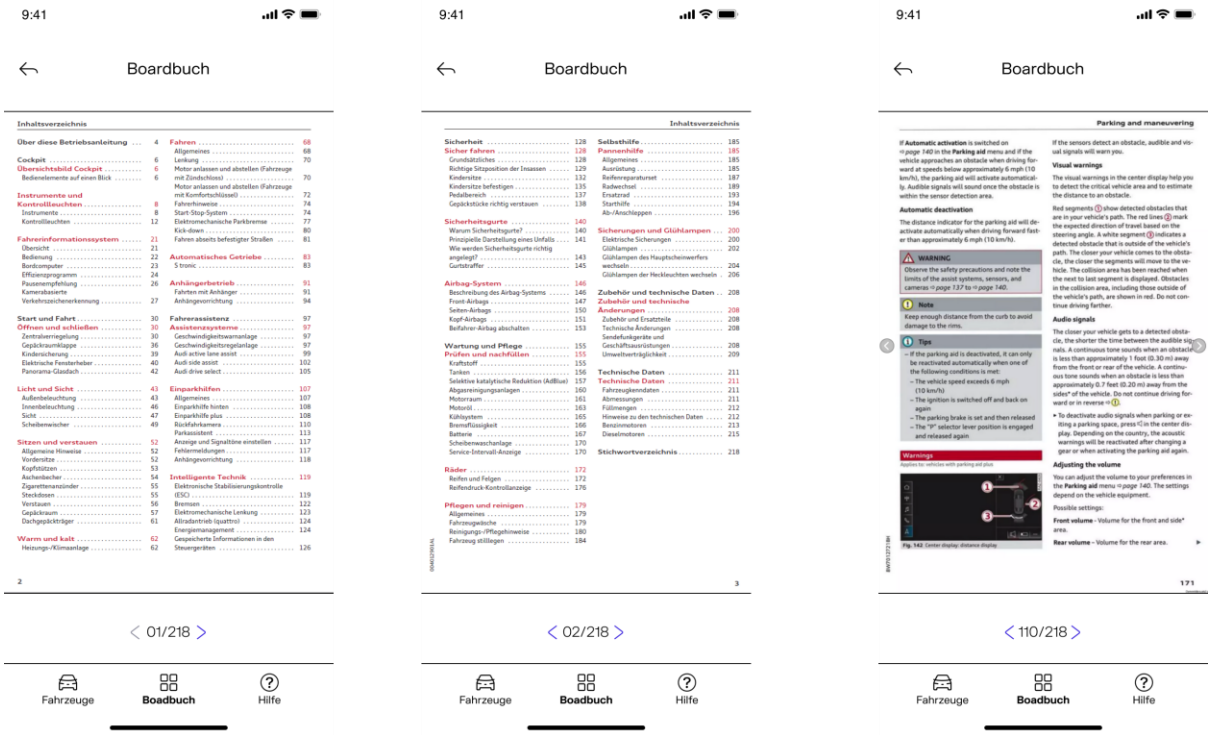
Overview pages of the respective cars in the 'Pragmatic' variant



Note. Above, the 3D model of the car is presented, offering a complete 360-degree view of both its interior and exterior. Below this, the specific features of the 'Pragmatic' variant for the selected model are displayed. **T**hese include a digital car manual and a search function

Figure D.3-2

First page of the digital car manual



Note. The table of contents provided hyperlinks to navigate faster to the respective topics

Figure D.3-3

First page of the search function of the 'Pragmatic' variant (left) and example for the searching result for ACC (right)

Nutzung von AI-Tools

Folgende AI-Tools:

- Chat GPT 4o
- Microsoft 365 Copilot Chat
- DeepL Write

wurden an vereinzelten Stellen zu folgenden Zwecken genutzt:

- Unterstützung bei der Übersetzung
- Beantwortung von grammatikalischen und orthografischen Fragen
- Finden geeigneter Wortalternativen zur Verbesserung des Schreibstils

Ich versichere, dass ich AI-Tools nicht zur Erstellung ganzer Texte oder zu anderen Zwecken als den hier aufgeführten genutzt habe.

Eidesstattliche Erklärung

Hiermit versichere ich, dass ich die vorgelegte Arbeit selbst verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt habe. Die aus fremden Quellen direkt oder indirekt übernommenen Texte, Gedankengänge, Konzepte, Grafiken usw. habe ich als solche gekennzeichnet und mit vollständigen Verweisen auf die jeweilige Quelle versehen.

Mir ist bewusst, dass die Nutzung mittels generativer KI erstellter Texte oder Inhalte keine Garantie für deren Qualität gewährleistet und ich die Verantwortung trage, falls es durch die Verwendung solcher Hilfsmittel zu fehlerhaften Inhalten, zu Verstößen gegen das Datenschutzrecht, Urheberrecht oder zu wissenschaftlichem Fehlverhalten (z.B. Plagiate) kommt.

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